



Transport for NSW

Hill Road upgrade at Sydney Olympic Park and Lidcombe

Review of Environmental Factors



Artist's impression of Hill Road at John Ian Wing Parade and new intersection upgrade for Carter Street Precinct access looking south. Subject to detailed design.



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Hill Road Upgrade

Review of Environmental Factors

Transport for NSW | November 2021

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Executive summary

The Proposal

Transport for NSW proposes to upgrade Hill Road between Parramatta Road and Old Hill Link Road (the Proposal). The Proposal is located in Lidcombe, near Sydney Olympic Park, and is within the Cumberland local government area (LGA), Parramatta LGA and the Greater Parramatta Priority Growth Area. Adjacent to the Proposal is the Carter Street Precinct, which is the industrial area identified in the *Carter Street Precinct Master Plan 2020* (DPIE, 2020) for redevelopment as a residential area. The Proposal would include the following key elements:

- upgrading Hill Road to include road widening to accommodate additional turn lanes from Parramatta Road to John Ian Wing Parade
- modifying Parramatta Road and Hill Road intersection to provide a widened footpath from Parramatta Road onto Hill Road (northbound) and a new left turn lane to improve traffic flow exiting Sydney Olympic Park
- constructing new shared user paths (SUP) for pedestrian and cyclist travel along the western side of Hill Road between Parramatta Road and Carter Street and on the eastern side of Hill Road between Carter Street and Stockyard Boulevard (formerly referred to as Green Spine Road)
- widening Bombay Street to include additional through and turn lanes at the intersection with Parramatta Road
- converting the Hill Road and Carter Street intersection to a left-in, left-out intersection
- upgrading the Hill Road and John Ian Wing Parade intersection with additional through and turn lanes at the Hill Road northbound approach and Stockyard Boulevard approach, as well as widening the footpath
- widening and signalling the M4 Motorway eastbound off ramp to Hill Road to reduce motorway queuing and improve traffic flow on Hill Road
- adjusting the kerb return on the northwest corner of the Birnie Avenue and Parramatta Road intersection.

Construction is planned to commence in 2023 and take about 18 months to complete.

For the purpose of this report, and the environmental assessment and maps contained herein, any reference made to Green Spine Road (previous road name nominated in Carter Street Precinct Master Plan) now refers to Stockyard Boulevard.

Need for the Proposal

Hill Road is a key north-south corridor connected to major roads like Parramatta Road, M4 Motorway and Holker Street. Hill Road is the only direct access from Parramatta Road into the western and northern areas of the Sydney Olympic Park and provides an important function for people wanting to use the Park's associated amenities and facilities. It also provides residents with access to and from the suburbs of Lidcombe, Wentworth Point and Newington, and has been identified as being key in supporting development of the Carter Street Precinct, Hill Road Master Plan and Sydney Olympic Park.

Funding for the project is from the NSW Government's Housing Acceleration Fund, which is administered by the Department of Planning, Industry and Environment. Other involvement in roads and active transport across the Carter Street and Sydney Olympic Park precincts, as well as Wentworth Point and Newington, comes from the City of Parramatta Council, through its operational responsibility for local roads in the area. The Proposal would build additional capacity

into the network to improve connectivity, reduce delays and travel times along Hill Road and support the existing and future development of these areas.

The upgrade will complement other NSW Government transport initiatives in the area, including the Westconnex motorway project, the development of the Sydney Metro West Link and the \$100 million upgrade at Homebush Bay Drive and Australia Avenue.

Planning and development work for the Parramatta Light Rail Stage 2 project is also underway, with the preferred route connecting Stage 1 and the Parramatta CBD to Ermington, Melrose Park, Wentworth Point, Sydney Olympic Park and Carter Street.

Proposal objectives

The objectives of the Proposal include:

- support development growth in the Carter Street Precinct
- improve traffic efficiency and accessibility to the Carter Street Precinct, Hill Road Master Plan and Sydney Olympic Park
- enable future transport network flexibility
- improve road safety and access for all road users
- minimise traffic disruptions on the surrounding road network during construction
- improve active transport links and access to public transport.

Options considered

Option 1: Do minimum

This option would result in no road or intersection upgrades along the Hill Road corridor or widening of footpaths. The existing conditions would be unchanged under this option, normal routine road maintenance would continue to be carried out.

Option 2: Upgrade Hill Road

This option would include upgrading Hill Road between Parramatta Road and Old Hill Link Road. This option also includes other required intersection upgrades to maintain vehicular access and improve movement at the following locations:

- Parramatta Road and Bombay Street
- Eastbound on ramp and Hill Road
- Hill Road and Carter Street
- Hill Road and John Ian Wing Parade
- Hill Road and Stockyard Boulevard (proposed)
- Parramatta Road and Birnie Avenue.

Option 2 would also include a new active transport link in the form of a new SUP for cyclists and pedestrians along the western side of Hill Road between Parramatta Road and Carter Street and the eastern side of Hill Road between Carter Street and John Ian Wing Parade (Stockyard Boulevard), the Carter Street Precinct and Sydney Olympic Park.

Preferred option

Option 2 was identified as the preferred option as it addresses the Proposal objectives and development criteria:

- aligns with NSW, regional and local strategic objectives, policies and long-range plans as defined in Section 2.1
- widening of Hill Road would support improved connections and accessibility to existing and future development including the Carter Street Precinct and Sydney Olympic Park
- inclusion of SUP and widened footpaths would promote active transport in the area
- kerb adjustments at the Birnie Road and Parramatta Road intersection would improve B-double and heavy vehicle access.

In developing the preferred option, ecologically sustainable development considerations were included to minimise environmental risks. The design of Option 2 considered minimising impacts to key issues of the area like vegetation, property acquisition, traffic, flooding and cultural significance.

Figure E-1 details the key design features of the Proposal.

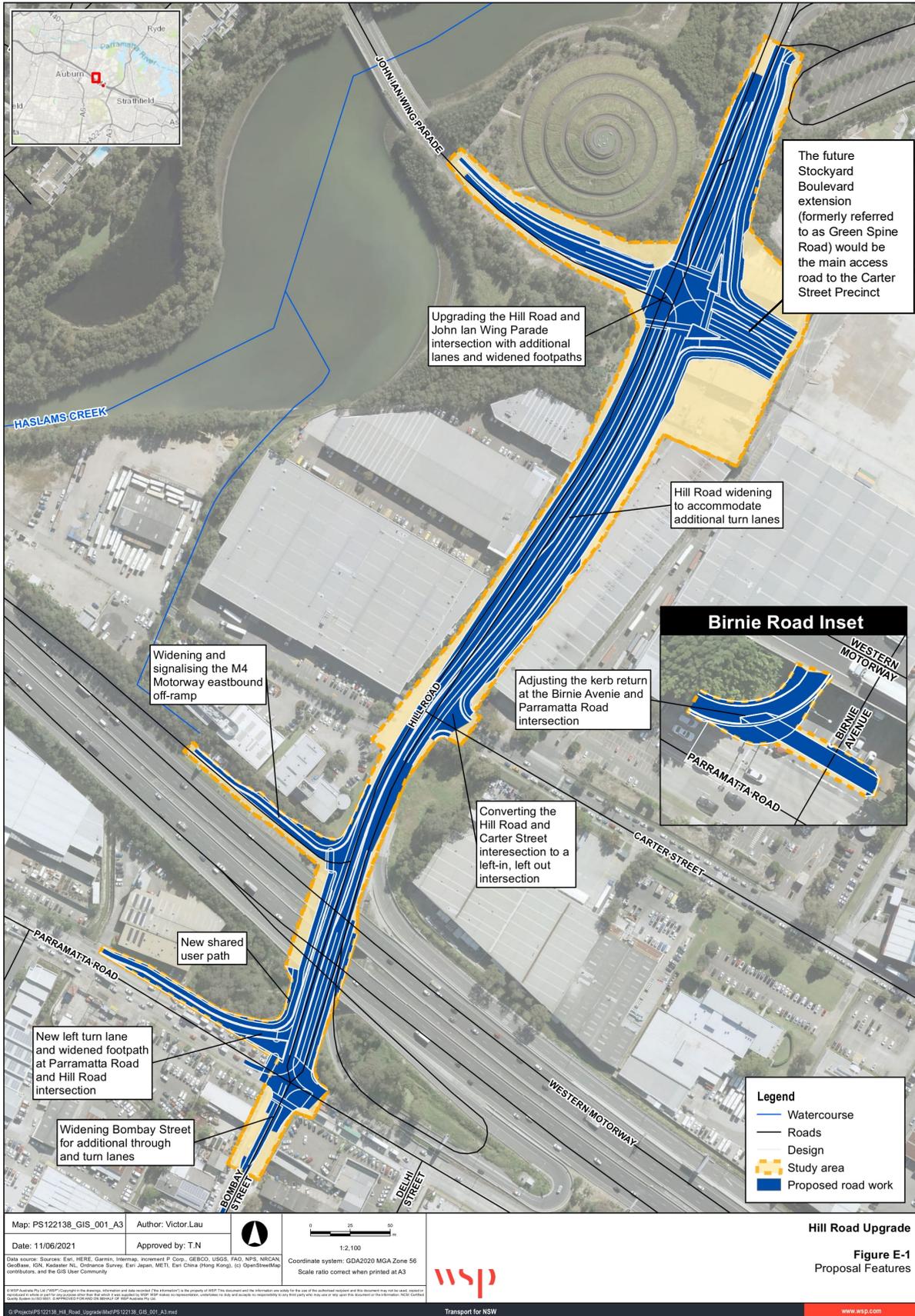


Figure E-1: Proposal features

Statutory and planning framework

The Proposal is for a road and would be carried out by Transport for NSW and can therefore be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. Development consent from City of Parramatta Council and Cumberland Council is not required.

Clause 94 of State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) permits development on any land for the purpose of a road to be carried out by or on behalf of a public authority without consent.

Transport for NSW has formed the view that the Proposal is not likely to significantly impact the environment and would not require the preparation of an Environmental Impact Statement (EIS). This review of environmental factors (REF) has been prepared as part of the assessment process.

Community and stakeholder consultation

In December 2020, Transport for NSW invited stakeholders and the community to comment on the Proposal through publishing a “Have your say” Community Notification. The notification was sent to more than 10,000 residents and businesses in Lidcombe, Sydney Olympic Park, Wentworth Point and Newington. Consultation was completed in February 2021 with 31 submissions received.

The feedback from the consultation can be summarised into the following broad themes:

- delay and congestion
- road and intersection design
- safety.

Transport for NSW has formally consulted with the City of Parramatta Council, Cumberland Council and State Emergency Services (SES) in accordance with the requirements of the ISEPP. The Sydney Olympic Park Authority (SOPA) was also consulted as a key stakeholder.

Transport for NSW will continue to consult with the community and stakeholders during the development of the Proposal. This REF will be publicly displayed for comment from 15 November to 12 December 2021 during which time the community and stakeholders will be invited to submit feedback on the Proposal to Transport for NSW. Submissions received during the public consultation period will be addressed in a formal Submissions Report and, if a decision is made to proceed with the Proposal, would be considered during detailed design.

Transport for NSW will review and assess all feedback received during the public consultation period, prior to determining whether or not to proceed with the Proposal. Should the Proposal proceed to construction, the community will be kept informed throughout the duration of the construction period. Figure E-2 shows the planning approval and consultation process for the Proposal.

The documents are available as pdf files on the Transport for NSW Hill Road Upgrade website at [nswroads.work/hill-road](https://www.nswroads.work/hill-road)

Submissions must be received before the close of the public consultation period for the REF. Submissions will be managed in accordance with the Transport for NSW Privacy Statement which can be found here <https://www.transport.nsw.gov.au/about-us/transport-privacy> or by contacting privacy@transport.nsw.gov.au for a copy.

During the public consultation period a Project Infoline (1800 792 086) and email address (hill.road@rms.nsw.gov.au) will also be available for members of the public to make enquiries and provide submissions.

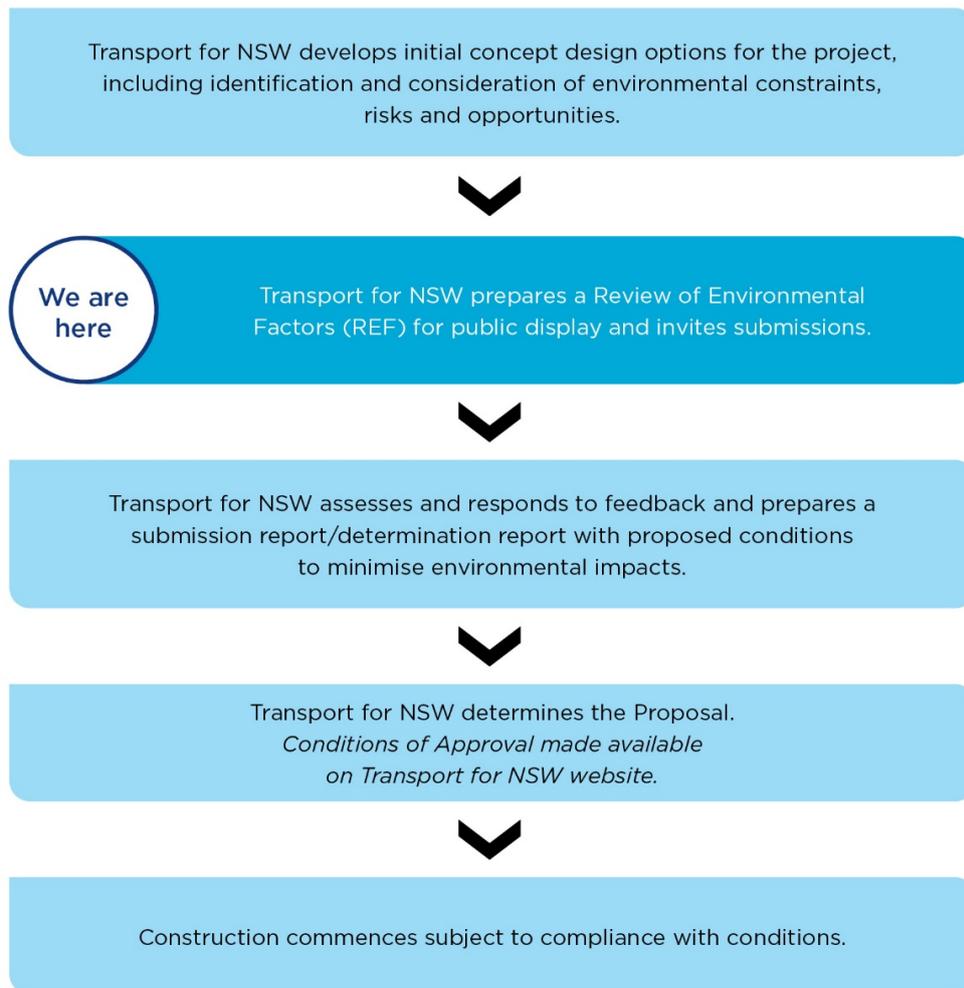


Figure E-2: Planning approval and consultation process

Following public consultation of the REF, all comments received would be individually responded to, recorded and summarised in a Submissions Report detailing how each issue raised would be considered in finalising the Proposal design. The Submissions Report will be published on the Hill Road Upgrade webpage on Transport for NSW's website at nswroads.work/hill-road

Environmental impacts

Detailed technical investigations have been carried out to assess, manage and minimise the Proposal's potential environmental impacts.

The Proposal's key impacts to the environment and surrounding community are outlined below. The safeguards and management measures identified in this REF would help minimise potential adverse impacts.

Traffic and transport

Construction activity for the Proposal would largely be confined to Hill Road corridor itself with minor disruptions (e.g. traffic delays resulting in increased travel time) to Parramatta Road from the intersection upgrades and the east bound off ramp M4 Motorway from road and lane closures. Activities which are likely to have a major impact on the road network performance would be undertaken outside of peak hours or at night.

During construction of the Proposal, increased traffic and road and lane closures would impact the road network performance on Hill Road. Service and access roads would also be impacted from the haulage of construction materials and service vehicles. Construction would also impact public and active transport routes where detours are required, resulting in increased travel times.

During operation, the Proposal would generally improve the road network performance as there would be an improvement in the average speed and reduced delays along Hill Road and the intersection with Carter Street.

The Proposal would offer satisfactory intersection performance at the Hill Road intersections at Old Hill Link Road, John Ian Wing Parade, M4 Motorway eastbound on ramp and M4 Motorway eastbound off ramp, primarily maintaining existing Level of Service (LOS) performance between LOS A to C. Traffic performance at the intersections along Parramatta Road are expected to remain heavily congested operating at LOS E or F.

The Proposal introduces a new road configuration impacting existing turning movements of light and heavy vehicles for commercial and industrial properties on the east and west side of Hill Road. However, alternative routes exist in the area resulting in minimal traffic impacts to vehicles accessing these properties.

Event day traffic impacts at Sydney Olympic Park would also occur during construction and operation of the Proposal. Consultation with SOPA on the Proposal's impacts during event days would be developed during detailed design and further construction planning.

Other potential traffic impacts during non-event days would be managed through a Traffic Management Plan with further consultation as required with surrounding property owners, bus operations and SOPA.

Noise and vibration

The environment within and around the Proposal is considered urban, with the dominant noise source being road traffic from the exiting and adjacent M4 Motorway as well as vehicle movements on Hill Road and Parramatta Road. The nearest sensitive residential and commercial receivers are located around 10 metres from the Proposal.

The noise and vibration impact assessment was prepared, acknowledging that although the Carter Street Precinct has received overall planning approval, many of the residential receivers identified in the Carter Street Precinct have not yet been constructed. As such, noise and vibration impacts assessed for receivers in the Carter Street Precinct represent a worst case scenario and the actual land use status of these properties would be confirmed before and during construction of the project.

Construction of the Proposal would exceed the Noise Management Levels (NMLs) and also result in sleep disturbance impacts at receivers in the three residential noise catchment areas surrounding the Proposal. In addition, commercial receivers along Parramatta Road are expected to be affected by noise generated by construction activities during construction.

Vibration impacts during construction has the potential to result in cosmetic damage at five residential receivers within the Carter Street Precinct, two residential receivers along Bombay Street as well as eight commercial receivers along Parramatta Road and the southern end of Hill Road. This could be during the use of a large hydraulic hammer, a piling rig and vibratory rollers/compactor.

Noise and vibration management measures to reduce noise and vibration impacts during construction include providing respite periods for high noise generating activities, selection of low noise and vibration emitting plant (where appropriate) and implementation of a monitoring program to assess performance against relevant noise and vibration criteria.

Operational noise impacts may result in exceedance of Noise Management Levels (NMLs) at six residential receivers of buildings in the future Carter Street Precinct. Predicted noise levels also identified NMLs exceedance for the future primary school and active use open space (as part of the future Carter Street Precinct). This is the worst case scenario, and the actual impact of the Proposal would be dependent on the timing and actual land use status of these properties. This would be confirmed before and during construction of the Proposal, and if assessed and deemed feasible and reasonable, additional noise mitigations would be provided.

Socio-economic

The Proposal is expected to have local and regional benefits through reduced delays, improved travel time, enhanced safety for all road users from the road upgrades and improved access for pedestrians and cyclists from the SUP.

During construction, the community and local businesses in the area would experience temporary traffic delays, noise and visual amenity impacts. There would be a minor temporary benefit to local businesses from the increased workforce spending on food, beverage and retail.

The Proposal would acquire about 0.5 hectares of land. There are no residential properties or social infrastructure required for property acquisition. It should be noted that there is a full acquisition of Lot 302/DP541070 (8,357 square metres) to accommodate the construction compound; however, at the completion of the Proposal, 3,757 square metres would be returned to City of Parramatta Council.

Transport for NSW would undertake all acquisition in accordance with current acquisition guidelines and the *Land Acquisition (Just Terms Compensation) Act 1991*.

Landscape character and visual impact

The Proposal is located primarily in an industrial and commercial area, with areas of recreational amenity to the north of the Proposal toward Sydney Olympic Park. Native vegetation has been largely cleared with only patches of small remnant vegetation along Hill Road and the eastbound M4 Motorway on ramp.

Construction of the Proposal would result in a temporary change to the landscape character and visual amenity from the establishment of the construction sites, the site compound and ancillary facilities. Construction impacts would be from a change to the existing composition of the landscape character and its setting, removal of small amounts of vegetation and the temporary introduction of machinery and equipment, stockpiles, and stored materials affecting the overall amenity and setting.

The main receivers impacted would be those overlooking the construction sites, site compound and ancillary facilities located on the east side of Hill Road near the proposed Stockyard Boulevard intersection. On completion of construction, impacted areas would be reinstated and landscaped.

The operation of the Proposal would align with a typical urban landscape and would be in keeping with the character of the local area. However, the completed Proposal would change the existing conditions associated with property acquisition and the introduction of new road infrastructure, landscaping and development. The Proposal would result in low and moderate visual impacts due to the increase of sensitive receptors from the land use change from the completed Carter Street Precinct.

Potential impacts are mitigated by a series of landscape and urban design mitigation strategies (e.g. Urban Design Plan, revegetation, tree planting) to minimise landscape and visual impacts from the Proposal.

Biodiversity

The Proposal would have a minimal impact on the 0.67 hectares of vegetation within the study area comprising one native plant community type (PCT) and one non-native vegetation type:

- PCT 724 Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin (0.03ha)
- Miscellaneous ecosystem – Urban exotic / native landscape plantings (0.64 ha)

The one native vegetation community, PCT 724 Broad-leaved Ironbark - Grey Box - *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin, is consistent with a *Biodiversity Conservation Act 2016* (BC Act) listed threatened ecological community Shale Gravel Transition Forest in the Sydney Basin Bioregion (Shale Gravel Transition Forest), and is listed as Endangered.

No threatened ecological communities listed under the *Environmental Protection Biodiversity Conservation Act 1999* (EPBC Act) were recorded within the study area.

No threatened flora species have been recorded or are considered affected by the Proposal.

As the Proposal is located in an existing urban development and adjacent roads, there is unlikely to be any further impacts from edge effects and impact to wildlife connectivity and habitat fragmentation as the removal of habitat is minor.

An assessment of significance has been carried out for threatened species and ecological communities that are likely to occur in the Proposal. The Proposal is not likely to significantly impact threatened species or ecological communities or their habitats, within the meaning of the BC Act or the *Fisheries Management Act 1994* (FM Act) and therefore a Species Impact Statement (SIS) or Biodiversity Development Assessment Report (BDAR) is not required.

The Proposal is unlikely to significantly impact threatened species, ecological communities or migratory species, within the meaning of the EPBC Act.

No biodiversity offsets are required to offset the impact to native vegetation or threatened species habitat identified from the Proposal.

Non-Aboriginal heritage

There would be direct physical impacts to the Auburn Local Environmental Plan (LEP) item I20 (a stand of Shale Gravel Transition Forest in the Sydney Basin Bioregion) from vegetation clearing on the southern and western edges of the LEP curtilage at the intersection of Parramatta Road and Hill Road. The Proposal would result in a minor direct physical impact to heritage item I20. This may be further minimised through detailed design.

The potential for significant archaeology to be located within the study area is low as the prevailing historic land uses of the study area have been for agricultural and industrial activities.

Hydrology and flooding

The Proposal is partially located within flood prone land. The Proposal is expected to be impacted by a 20% annual exceedance probability (AEP) flood event at the Hill Road and John Ian Wing Parade intersection (adjacent to the location of the proposed site compound), the Hill Road and M4 Motorway underpass and Parramatta Road. Impacts have the potential to change overland flow regimes and obstruct drainage paths which may result in temporary localised flooding. Flooding also has the potential to increase the risk of erosion and sedimentation particularly in areas where vegetation clearing, or excavation have been undertaken or stockpiles are located.

To minimise the potential for localised flooding during construction, it would be necessary to plan, implement and maintain measures aimed at intercepting any concentrated flow and diverting it toward the existing stormwater drainage system. Monitoring of weather and moveable plant and equipment on the construction sites would also be required to manage flood risk throughout construction.

During operation, the Proposal would result in a minor increase in the impervious area for the Haslams Creek Catchment, as well as a minor increase in peak flow at the Haslams Creek Tributary (Arthur Branch channel) due to the increased hydraulic connectivity between Hill Road and Parramatta Road. The increase is not expected to significantly modify the catchment as changes to total flow volume are less than 1% across all AEP design events. Although the Proposal is unable to completely reduce peak flood levels in the 1% AEP, the flood impacts would remain generally confined to the Proposal.

These changes in road elevation would also result in modifications to drainage flow paths, which would impact localised flood depths and is likely to lead to some new wet areas, as flood waters previously contained within the existing road reserve are likely to flow to the edge of the Proposal. Flooding impacts are confined to the Proposal and are expected to be minor.

Surface water and groundwater

Construction works of the Proposal have the potential to impact on surface water. The main risk is from sediment runoff or degraded water quality caused by excavation, vegetation removal and other surface work, particularly before or during periods of heavy rain. Erosion and sedimentation control measures are proposed to manage potential surface water quality issues.

Existing groundwater levels and flow levels are not expected to have any impacts as there are no deep excavations that may encounter the groundwater table.

During operations, alterations to the surface water flows are expected to be within the capacity of the stormwater network. There is a potential for pollutant deposit built up on road surfaces and pavement areas during dry weather and are likely to be washed into watercourses during wet weather. The Proposal would implement Gross Pollutant Traps (GPT), as required. The installation of GPTs or similar stormwater treatment systems are likely to provide a reduction in pollutant loads and provide opportunity to capture a certain volume of accidental oil/fuel spill.

Contamination

The land use near and within the Proposal study area includes a number of medium to large sized operational commercial businesses. The types of business are primarily industrial such as retail warehousing, mechanical equipment, high-tech speciality chemicals and automotive businesses.

The Proposal is located adjacent to the Sydney Olympic Park site and the Homebush Bay area where extensive landfilling and reclamation using uncontrolled waste took place across the Sydney Olympic Park early 1980s. The Proposal would not be impacting any known landfill area, however there is still a possibility of historical fill material may be beneath the study area.

Potential contamination would be managed during construction via a Contaminated Land Management Plan, prepared in accordance with the *Guideline for the Management of Contamination* (TfNSW, 2013) and implemented as part of the CEMP.

Cumulative impacts

A number of medium to large scale developments are currently being constructed or planned near the Proposal. There is the potential for temporary cumulative impacts, including noise and vibration, traffic and transport, air quality and visual amenity impacts, during construction should construction works and activities overlap in terms of timing and/or location.

The Consultation Plan would include consultation with proponents of nearby projects to increase awareness of construction timeframes and coordinate impact mitigation and management measures such as where possible avoiding long-term overlapping of out-of-hours work.

During operation, the Proposal and adjoining road upgrades would have a positive cumulative impact on road safety and traffic flows within the area.

Over the long term, the Proposal and other developments being planned are expected to deliver social and economic benefits to the region through improvements in active transport connections, traffic flows, road safety, urban amenity and employment and business opportunities.

Justification and conclusion

As the Proposal is for a road and road infrastructure facilities and is to be carried out on behalf of Transport for NSW, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Transport for NSW is the determining authority for the Proposal. This REF fulfils Transport for NSW's obligation under Section 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

The Proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an EIS to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.2 of the EP&A Act. A BDAR or SIS is not required. The Proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from City of Parramatta Council and Cumberland Council is not required.

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 Agriculture, Water and the Environment is not required.

While there would be some impacts to the environment as a result of the Proposal, they have been avoided or minimised wherever possible through design development and site specific safeguards.

The Proposal is considered consistent with state and local transport strategies to improve the road safety and efficiency and would help to meet ongoing and future road network needs. The Proposal would support improved access through the area and facilitate pedestrians, cyclists and vehicle access to urban renewal projects. On balance, the Proposal's long-term benefits outweigh its impacts, and the Proposal is considered to be justified.

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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 development history are detailed and the purpose of the report provided.

1.1 Proposal identification

Transport for NSW proposes to upgrade Hill Road between Parramatta Road and Old Hill Link Road (the Proposal). The Proposal is located in Lidcombe, near Sydney Olympic Park, and is within the Cumberland local government area (LGA), Parramatta LGA and the Greater Parramatta Priority Growth Area. Under the Carter Street Master Plan, the industrial area adjacent to Hill Road was identified for redevelopment as a residential area known as the Carter Street Precinct. The Master Plan was finalised on 18 December 2020 and was enacted through an amendment of the Auburn Local Environmental Plan 2010. The Proposal has been developed to support the objectives of the Carter Street Precinct.

The Proposal would include the following key elements:

- upgrading Hill Road to include road widening to accommodate additional turn lanes from Parramatta Road to John Ian Wing Parade
- modifying Parramatta Road and Hill Road intersection to provide a widened footpath from Parramatta Road onto Hill Road (northbound) and a new left turn lane to improve traffic flow exiting Sydney Olympic Park
- construction of a new shared user paths (SUP) for pedestrian and cyclist travel along the western side of Hill Road between Parramatta Road and Carter Street and on the eastern side of Hill Road between Carter Street and Stockyard Boulevard (formerly referred to as Green Spine Road)
- widening Bombay Street to include additional through and turn lanes at the intersection with Parramatta Road
- converting the Hill Road and Carter Street intersection to a left-in, left-out intersection
- upgrading the Hill Road and John Ian Wing Parade intersection with additional through and turn lanes at the Hill Road northbound approach and Stockyard Boulevard approach, as well as widening the footpath
- widening and signalling the M4 Motorway eastbound off ramp to Hill Road to reduce motorway queuing and improve traffic flow on Hill Road
- adjusting the kerb return on the northwest corner of the Birnie Avenue and Parramatta Road intersection.

The Proposal overview is shown in Figure 1-1. Chapter 3 describes the Proposal in more detail.

For the purpose of this report, and the environmental assessment and maps contained herein, any reference made to Green Spine Road (previous road name nominated in Carter Street Precinct Master Plan) now refers to Stockyard Boulevard.

1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by WSP on behalf of Transport for NSW, Greater Sydney Division. For the purposes of these works, Transport for NSW 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 Transport for NSW 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 and Public Spaces under Division 5.2 of the EP&A Act
- The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report
- The significance of any impact on nationally listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and 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 Agriculture, Water and the Environment for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

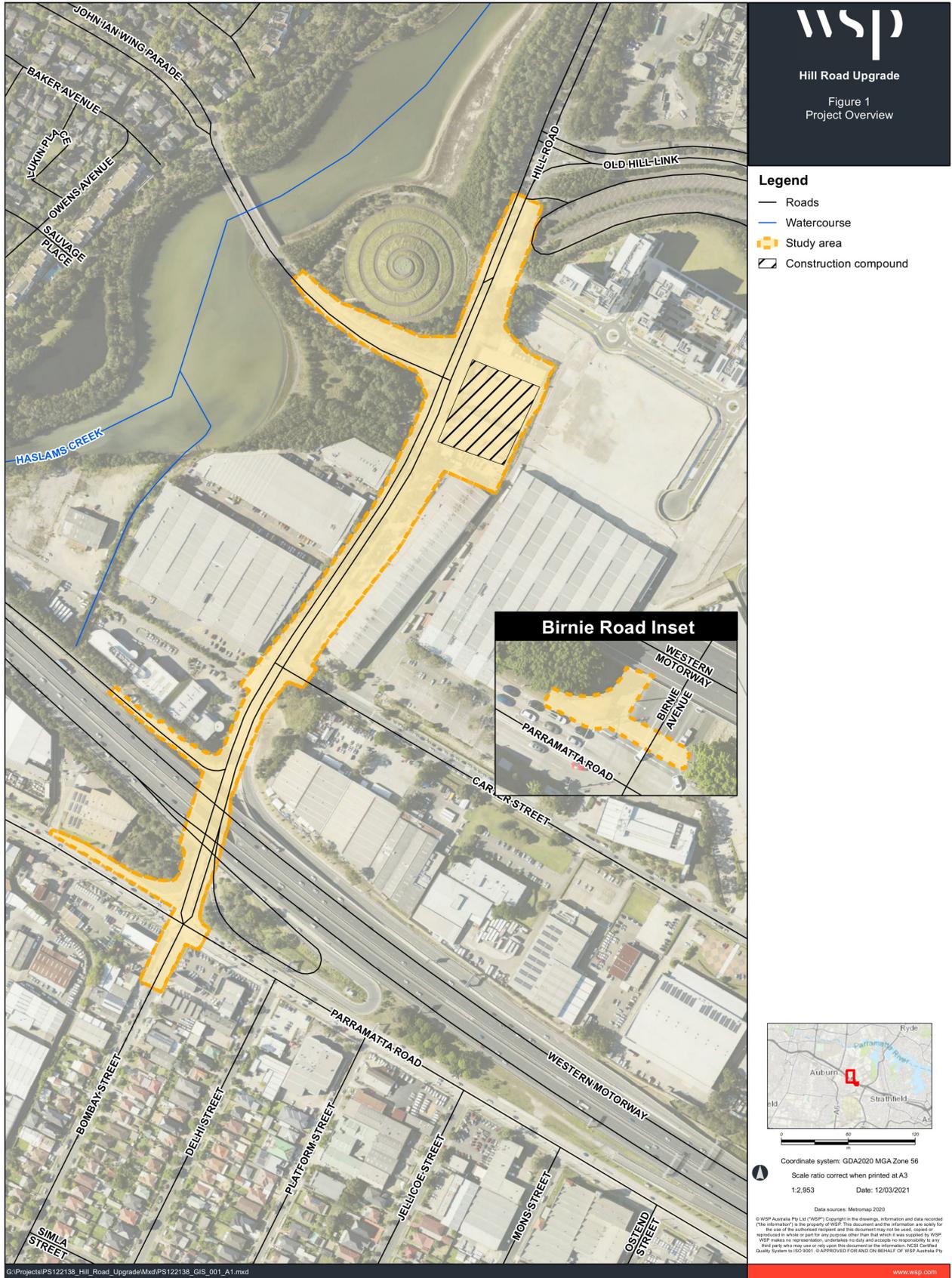


Figure 1-1: Proposal overview

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 options considered and the selection of the preferred option.

2.1 Strategic need for the Proposal

Hill Road is a key north-south corridor connected to major roads like Parramatta Road, M4 Motorway and Holker Street. Hill Road is the only direct access from Parramatta Road into the western and northern areas of the Sydney Olympic Park and provides an important function for people wanting to use the park's associated amenities and facilities. It also provides residents with access to and from the suburbs of Lidcombe, Wentworth Point and Newington, and has been identified as being key in supporting development of the Carter Street Precinct, Hill Road Master Plan and Sydney Olympic Park.

The Proposal would build additional capacity into the network to reduce delays and travel times along Hill Road and support the existing and future development of these areas.

2.1.1 NSW Premiers and State priorities

The NSW Government has identified 14 Premier's priorities (NSW Government, 2019) for the state to grow the economy, deliver well connected communities with quality local environments, provide high quality education and break the cycle of disadvantage.

Premier Priority 11 aims to increase the proportion of homes in urban areas within 10 minutes' walk of quality green, open and public space by 10 per cent by 2023. The Proposal would address this priority by improving the walkability, connectivity and accessibility of public spaces along Hill Road which will promote healthier lifestyles and bring people from surrounding residential neighbourhoods together.

2.1.2 NSW Infrastructure Strategy 2018-2038

The *NSW Infrastructure Strategy 2018-2038* (NSW Government, 2018) builds on the NSW Government's major long-term infrastructure plans over the last seven years from the 2012 State Infrastructure Strategy and Long Term Transport Master Plan and 2014 State Infrastructure Strategy Update.

The *NSW Infrastructure Strategy 2018-2038* switches the focus from developing an infrastructure project pipeline to achieving sustainable growth in the NSW population and economy – aligning investment in infrastructure with the way we build our communities and achieve innovation in service delivery.

Based on the Proposal's scope of works (Section 3.1) and objectives (Section 2.2.1), the Proposal specifically supports two of the six strategic directions:

- integrating land use and infrastructure planning
- infrastructure planning, prioritisation and delivery.

2.1.3 Future Transport Strategy 2056

The *NSW Future Transport Strategy 2056* (TfNSW, 2018a) outlines a clear framework to address transport challenges in NSW over the next 40 years and is an update of the NSW Long Term Transport Master Plan released in 2012. It integrates planning for roads, freight and all other modes of transport and sets out initiatives, solutions and actions to meet NSW transport challenges.

The Proposal's upgrade of improved road infrastructure and active transport supports the existing and future development of the area and aligns with the following Future Transport Strategy 2056 visions:

- liveability, amenity and economic success of communities and places are enhanced by transport
- every customer enjoys safe travel, regardless of transport mode or location, across a high-performing, integrated and efficient network
- transport enables everyone to get the most out of life, wherever they live and whatever their age, ability or personal circumstances.

Specifically, the Proposal is consistent with the Future Transport Strategy 2056 by:

- facilitating the renewal of the Olympic Peninsula, which would provide greater local opportunities for residents to access jobs within 30 minutes
- improving road connections to all Three Cities (detailed in Section 2.1.5)
- providing additional active transport infrastructure that improves liveability and provides improved local and sub-regional connections.

2.1.4 Road Safety Plan 2021

The *Road Safety Plan 2021* (TfNSW, 2018b) outlines how the NSW Government will work towards the State Priority Target of reducing fatalities by 30 per cent by 2021 (compared to average annual fatalities over 2008–2010). It also aligns the Towards Zero vision with Future Transport Strategy 2056, which aims to have NSW transport network with zero trauma by 2056.

The Proposal is consistent with the directions set out in *Road Safety Plan 2021* as it would provide a better standard of road with improved safety design and provision of improved intersections and active transport links.

2.1.5 Greater Sydney Region Plan

The *Greater Sydney Region Plan - A Metropolis of Three Cities* (Greater Sydney Commission, 2018a) envisages three cities where most residents live within 30 minutes of their jobs, education and health facilities, services and leisure opportunities. The plan includes a framework that emphasises how the principal spatial elements of the city are interconnected and integrated to best deliver in four critical areas:

- integration of the mass transit network with the economic corridors, centres, transit-oriented development, urban renewal and health and education precincts
- connectivity between the rail, freight and strategic road networks and the trade gateways and industrial areas
- integration of the green grid network with residential neighbourhoods
- retention of the integrity of the values of the Metropolitan Rural Area and the Protected Natural Area.

The plan includes ten directions with related objectives, strategies and actions. The Proposal directly aligns with the direction of 'A city supported by infrastructure' and the following related objectives:

- Objective 1 – Infrastructure supports the three cities
- Objective 2 – Infrastructure aligns with forecast growth – growth infrastructure compact
- Objective 3 – Infrastructure adapts to meet future needs.

The Proposal also supports the following identified directions as part of the Plan's objectives:

- a city supported by infrastructure
- a well-connected city.

2.1.6 Our Greater Sydney 2056 – Central City District Plan

The *Central City District Plan* (Greater Sydney Commission, 2018b) is a 20-year plan to manage growth in the context of economic, social and environmental matters to achieve the 40-year vision of Greater Sydney. It is a guide for implementing the Greater Sydney Region Plan, A Metropolis of Three Cities, at a district level and is a bridge between regional and local planning. The Central City District covers the Blacktown, Cumberland Parramatta and the Hills LGAs.

Based on the Proposal's scope of works (Section 3.1) and objectives (Section 2.2.1), the Proposal specifically supports the following planning priorities:

- planning for a city supported by infrastructure
- providing services and social infrastructure to meet people's changing needs
- creating and renewing great places and local centres and respecting the District's heritage
- delivering integrated land use and transport planning and a 30-minute city
- growing investment, business opportunities and jobs in strategic centres.

2.1.7 Greater Parramatta Interim Land Use and Infrastructure Implementation Plan

The *Greater Parramatta Interim Land Use and Infrastructure Implementation Plan* (NSW, 2017) aims to develop a land use framework to guide future redevelopment of the Greater Parramatta Growth Area and identify and plan for infrastructure needed to unlock its potential.

The Proposal aligns with this plan as it provides improved connectivity (vehicular and active) within the Greater Parramatta Growth Area.

2.1.8 Sydney Olympic Park Master Plan 2030

The *Sydney Olympic Park Master Plan 2030* (SOPA, 2018) is a comprehensive plan guiding the long-term development of Sydney Olympic Park (the Park). The Park will continue to be a major event destination, enhance our environmental and recreational value and provide ongoing support to the development of community and elite sports.

In the Park's next stage of development, it has an important role to play to support the Greater Sydney Commission's Three Cities approach and has been identified as a "lifestyle" precinct within Greater Parramatta and the Olympic Peninsula. The *Sydney Olympic Master Plan 2030* is a plan for the revitalisation of the Park with a vibrant new town centre, educational facilities, shopping precinct, new homes, more jobs and increased open space and community facilities. It will enable the Park to continue to deliver outstanding social, economic and environmental benefits for the people of Sydney and NSW.

As mentioned in Section 2.1, the Proposal is a key connection to and from the Park and supports the following goal:

- major transport infrastructure projects will support the evolution of the precinct and enhance Sydney Olympic Park's role as a premier destination for cultural, entertainment, recreation and sporting events.

2.1.9 Carter Street Precinct Master Plan 2020

The *Carter Street Precinct Master Plan 2020* (DPIE, 2020) defines the future development of the Carter Street Precinct (the Precinct). The Precinct is located within the Central City District (as defined in Section 2.1.6) and is an urban renewal area adjacent to Sydney Olympic Park.

The Master Plan includes 6,200 dwellings, 12,000 square metres of retail floor space, three hectares of open space with pedestrian and cycle paths, community centre, site for a future primary school and the widening of Hill Road.

The Proposal's upgrade of Hill Road aligns with the future development of the Precinct as it specifically supports the following key features of the Master Plan:

- a major-east west pedestrian spine, linking the Precinct to Haslams Creek and Sydney Olympic Park
- upgrades to Hill Road including landscape verges, cycle and pedestrian pathways
- a movement network that connects major destinations, including Haslams Creek, public open spaces, the primary school site, village centre and the potential Parramatta Light Rail (Stage 2)
- a framework for new and future connections to Sydney Olympic Park and adjoining areas
- new entrances to the Precinct that complement the character of Sydney Olympic Park.

2.1.10 Hill Road Master Plan

The *Hill Road Master Plan* (City of Parramatta, 2021) is a strategic implementation tool intended to help drive future improvement outcomes to improve the Wentworth Point community by making Hill Road more environmentally sustainable, liveable, and a resilient precinct. The *Hill Road Master Plan* focuses on upgrades along Hill Road between Holker Street and the Wentworth Point peninsula toward the Parramatta River, which is classified as a Local Road and located approximately 1.3 kilometres north of the Proposal.

The Hill Road Master Plan aims to:

- transform Hill Road into an identifiable boulevard with a high quality public domain
- provide a safer place for pedestrians, cyclists and road users
- promote environmental outcomes, urban ecology and facilitate green infrastructure
- improve pedestrian connections and active transport links.

The objectives of the Proposal is consistent with the objectives of providing improved connectivity (vehicular and active) along Hill Road and improved access to Wentworth Point.

2.2 Proposal objectives and development criteria

2.2.1 Proposal objectives

The objectives of the Proposal include:

- support development growth in the Carter Street Precinct
- improve traffic efficiency and accessibility to the Carter Street Precinct, Hill Road Master Plan and Sydney Olympic Park
- enable future transport network flexibility
- improve road safety and access for all road users
- minimise traffic disruptions on the surrounding road network during construction
- improve active transport connections and access to public transport.

2.2.2 Urban design standards and principles

The corridor principally provides for the movement of general traffic, freight and buses in a north-south direction. It also has place characteristics, with a combination of commercial, recreational and residential developments generating pedestrian and cyclist activity.

For the section of Hill Road between cross streets of Carter Street and John Ian Wing Parade, the Carter Street Precinct Development Framework provides the vision for an integrated transport corridor. The corridor will promote place making opportunities, urban streetscape amenity and pedestrian and cyclist connectivity but still manages traffic demand without excessive delays.

For the section of Hill Road between Carter Street and Parramatta Road not covered by the Carter Street Precinct Development Framework, the following urban design standards apply:

- Crime prevention and the assessment of development applications (DUAC, 2001)
- Crime Prevention through Environmental Design (CPTED, Queensland Government, 2007)
- Beyond the Pavement (RMS, 2018)
- Disability (Access to Premises – Buildings) Standards 2010
- Technical Guideline for Urban Green Cover in NSW (NSW Government, 2015)
- Healthy Urban Development Checklist (NSW health, 2009)
- Landscape Guideline (RMS, 2018).

The Proposal would also have the following key design principles:

- provide a design that contributes to the character of the area and the experience of the road user
- reinforce the physical and visual relationship between the eastern and western sides of Hill Road
- provide tree canopy at the Hill Road and Parramatta Road intersection and planted vegetation and landscaping along Hill Road and at the John Ian Wing Parade intersection
- provide a cohesive and legible pedestrian and cycle network.

2.3 Options considered

The options assessment considered two options:

- Option 1: Do Minimum
- Option 2: Upgrade Hill Road.

The selection of the preferred option would align with the strategic need, in accordance with the documents referenced in Section 2.1, along with the Proposal's objectives, development criteria and urban design standards and principles.

Stakeholder consultation and community engagement began in 2017 and has continued through to 2021. Following the invitation to the community and stakeholders through a 'Have your say' consultation from December 2020 to February 2021, the feedback received was considered in the design development of the Proposal. Further community and stakeholder consultation details are discussed in Chapter 5.

2.3.1 Identified options

Option 1: Do Minimum

This option would result in no road or intersection upgrades along the Hill Road corridor or widening of footpaths. The existing conditions would be unchanged under this option, normal routine road maintenance would continue to be carried out.

Option 2: Upgrade Hill Road

This option would include upgrading Hill Road between Parramatta Road and Old Hill Link Road. This option also includes other required intersection upgrades to maintain vehicular access and improve movement at the following locations:

- Parramatta Road and Bombay Street
- Eastbound on ramp and Hill Road
- Hill Road and Carter Street
- Hill Road and John Ian Wing Parade
- Hill Road and Stockyard Boulevard (proposed)
- Parramatta Road and Birnie Avenue.

Option 2 would also include a new active transport link in the form of a new SUP which would be provided along the western side of Hill Road between Parramatta Road and Carter Street and the eastern side of Hill Road between Carter Street and John Ian Wing Parade (Stockyard Boulevard), the Carter Street Precinct and Sydney Olympic Park.

2.3.2 Analysis of options

Each option was reviewed against the Proposal objectives outlined in Section 2.2.1. A summary of the options analysis is provided in Table 2-1 below.

Table 2-1: Summary analysis of options with key objectives

Key Objective	Option 1	Option 2
Support development growth in the Carter Street Precinct	X	✓
Improve traffic efficiency and accessibility to the Carter Street Precinct and Sydney Olympic Park	X	✓
Enable future transport network flexibility	X	✓
Improve road safety and access for all road users	X	✓
Minimise traffic disruptions on the surrounding road network during construction.	✓	✓
Improve active transport connections and access to public transport.	X	✓

Option 1: Do Minimum

When considering the ‘Do Minimum’ option against the Proposal objectives, it was found that this option:

- would not improve intersection performance, safety and trip reliability along Hill Road.
- intersection delays would increase noticeably as population grows and major projects in the Carter Street Precinct, Sydney Olympic Park and Wentworth Point precincts begin operation.
- the intersection at John Ian Wing Parade would not be upgraded in line with the Carter Street Master Plan.

As the ‘Do Minimum’ option did not fulfil the majority of the Proposal objectives, there was no further analysis of how the Proposal performed against the development criteria and this option was discounted from further consideration.

Option 2: Upgrade Hill Road

The intersection at Hill Road and John Ian Wing Parade is identified for upgrade in the Carter Street Precinct Master Plan from a three-way to a four-way intersection. Additional upgrades were also identified as Hill Road is the main connection from Parramatta Road and provides the most direct, safe and efficient route to the Carter Street Precinct and Sydney Olympic Park. The Proposal supports the existing and future developments in the wider peninsula and the road upgrades have been developed to complement the objectives of the Carter Street Master Plan. Option 2 also aligns with all of the Proposal objectives outlined in Section 2.2.1 and was therefore selected as the preferred option.

2.3.3 Sub-options

Option 2 was refined further to include a number of sub-options. Table 2-2 summarises the sub-options as well as the justification for the preferred design outcome.

Table 2-2: Hill Road sub-options

Feature	Design development considerations	Justification for preferred design outcome
Hill Road upgrade	<p>The following were design considerations for Hill Road Upgrade:</p> <ul style="list-style-type: none"> a. road widening on the east b. road widening on the west c. road widening on both the east and west 	<p>Between 2014 and 2018, the Carter Street Precinct location was unknown due to property acquisition availability and timing. The location was confirmed in 2019. Sub-option A was identified as the preferred design outcome for the Proposal because it required the least amount of property acquisition.</p>
Parramatta Road and Hill Road intersection	<p>The following road configurations were considered:</p> <ul style="list-style-type: none"> a. one through lane northbound and two through lanes southbound with widened median b. two through lanes northbound and one through lane southbound with widened median c. two lanes northbound (with one controlled right turn lane) and two through lanes southbound from Hill Road to Parramatta Road. 	<p>Sub-option C was identified as the preferred design outcome as it would best support the traffic demands and safety requirements for existing and future development.</p>
M4 Eastbound off ramp at Hill Road	<p>Three off ramp designs were considered:</p> <ul style="list-style-type: none"> a. un-signalised b. signalised c. 50 metres of additional off ramp lane and signalised 	<p>Sub-option C was identified as the preferred design outcome as it would best support the existing and future traffic demands. This sub-option would also minimise queuing along Hill Road.</p>
Pedestrian amenity	<p>Two design were considered for upgrading pedestrian amenity:</p> <ul style="list-style-type: none"> a. add new crossing using markings and signals on all approaches of the Hill Road and John Ian Wing Parade intersection b. add new crossing using markings and signals on all approaches of the Hill Road and John Ian Wing Parade intersection, and add SUP on the eastern side of Hill Road between Carter Street and Stockyard Boulevard, and add new SUP on the western side between Parramatta Road and Carter Street. 	<p>Sub-option B was identified as the preferred design outcome as it would provide the most direct and safe active transport connections to existing and future development. This sub-option would also align with the area's active transport plan.</p>

2.1 Preferred option

Option 2 was identified as the preferred option as described in the options analysis in Section 2.3.2.

In summary, Option 2 meets the following objectives and development criteria:

- addresses and aligns with NSW, regional and local strategic objectives, policies and long-range plans as defined in Section 2.1
- the widening of Hill Road would support improved connections and accessibility to existing and future development including the Carter Street Precinct and Sydney Olympic Park
- inclusion of SUP and widened footpaths would promote active transport in the area
- kerb adjustments at the Birnie Road and Parramatta Road intersection to improve B-double vehicle access.

In developing the preferred option, ecologically sustainable development considerations were included to minimise environmental risks. The design of Option 2 considered minimising impacts to key issues of the area like vegetation, property acquisition, traffic, flooding and cultural significance. Further details of the assessed impacts are in Chapter 6.

3. Description of the Proposal

Chapter 3 describes the Proposal and summarises key design parameters, features, construction method, and associated infrastructure and activities. The description of the Proposal is based on concept design and is subject to detailed design.

3.1 The Proposal

Transport for NSW proposes to upgrade Hill Road between Parramatta Road and John Ian Wing Parade (the Proposal). The Proposal features are shown in Figure 3-1.

Key features of the Proposal would include:

- upgrading Hill Road:
 - widening 700 metres of Hill Road between M4 Motorway and Old Hill Link Road to include:
 - two northbound lanes from Parramatta Road to the John Ian Wing Parade intersection
 - two northbound right-turn lanes at the John Ian Wing Parade intersection on to Stockyard Boulevard
 - three southbound lanes between the John Ian Wing Parade intersection and the eastbound M4 Motorway on ramp
 - constructing a new shared user path (SUP) on the western side of Hill Road between Parramatta Road and Carter Street and on the eastern side of Hill Road between Carter Street and John Ian Wing Parade/Stockyard Boulevard. The SUP would be connected via a new signalised pedestrian crossing on Hill Road north of the M4 Motorway eastbound off ramp
 - modifying Parramatta Road and Hill Road intersection
 - left turn only lane connecting eastbound side traffic from Parramatta Road to the northbound side of the Hill Road
 - widening of the existing footpath on the north side of Parramatta Road that connects to Hill Road
 - widening Bombay Street to include an additional northbound lane including a dedicated right turn, left turn and through lanes at Parramatta Road intersection
 - converting the Carter Street intersection from a T-intersection that currently caters for all movements to a left-in, left-out intersection, installing a median and maintaining the existing two through lanes northbound on Hill Road
 - upgrading the intersection at Hill Road and John Ian Wing Parade to create a four-way intersection
 - installing a barrier to protect the M4 Motorway overpass bridge piers and construction of a new retaining wall to allow for the new SUP on the western side of Hill Road
 - upgrading the eastbound M4 Motorway off ramp by signalising and widening to two lanes
 - kerb adjustment at Birnie Avenue and Parramatta Road intersection
 - protecting, adjusting and relocating utilities
 - installing and adjusting street furniture including signage and lighting
 - improving existing road drainage
 - establishing temporary site compounds and materials storage for construction of the Proposal.

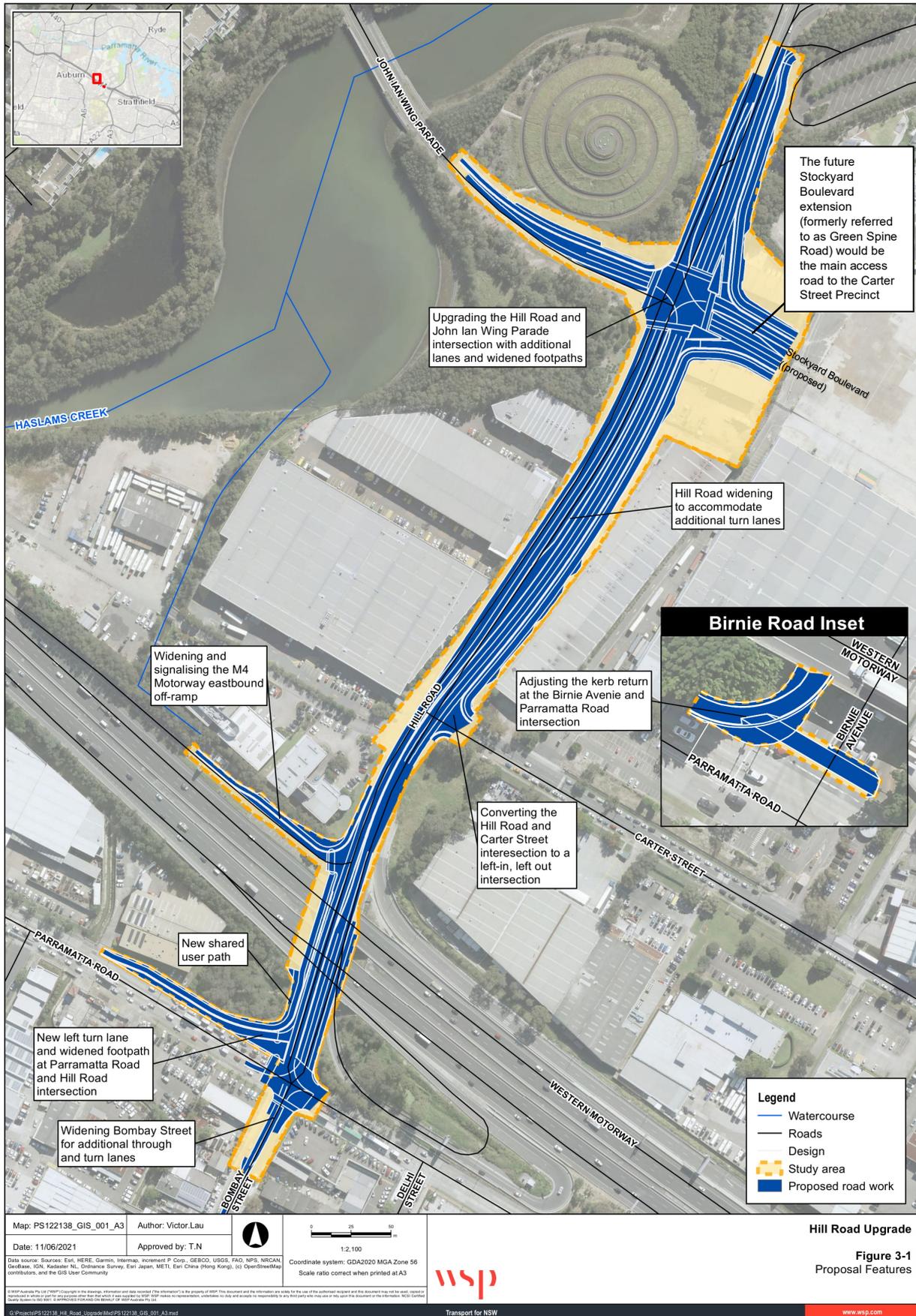


Figure 3-1: Proposal features

3.2 Design

The concept design was prepared to meet the Proposal objectives and is described in the following sections. The proposed concept design would be developed further during the detailed design stage.

3.2.1 Design criteria

The design criteria and reference documents that have been applied to the concept design of the Proposal include the following:

- Austroads Guide to Road Design (Austroads, 2009) and RMS supplements to Austroads Guide to Road Design Set
- RMS Road Design Guide
- Austroads Publications
- Australian Standards
- Standards Australia Handbooks
- Local Government Standards (where applicable).

The following considerations have informed the concept design:

- the Proposal objectives, as detailed in Section 2.3
- 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 Figure 3-2 shows a section view of the Proposal along Hill Road.

Table 3-1: Design criteria

Key element	Description
Posted speed	<ul style="list-style-type: none">• 60 km/h: Hill Road, Birnie Avenue• 50 km/h: John Ian Wing Parade
Design speed	<ul style="list-style-type: none">• 50 km/h: Stockyard Boulevard• 60 km/h: Hill Road, John Ian Wing Parade, Birnie Avenue, Parramatta Road (approach to left turn slip lane)
Lane widths	<ul style="list-style-type: none">• 3.5 metres:<ul style="list-style-type: none">• Hill Road (between Carter Street and John Ian Wing Parade)• John Ian Wing Parade (eastbound)• Stockyard Boulevard• John Ian Wing Parade (westbound)• Birnie Avenue
Left and right turn auxiliary lane widths	<ul style="list-style-type: none">• 3.5 metres:<ul style="list-style-type: none">• Hill Road (between Carter Street and John Ian Wing Parade)• John Ian Wing Parade (eastbound)• Stockyard Boulevard

Key element	Description
Median width	<ul style="list-style-type: none"> Up to 5.2 metres wide (50 metres long along John Ian Wing Parade) Up to 6.5 metres wide (southbound on Hill Street between Stockyard Boulevard and Carter Street) Up to 5.0 metres wide (northbound on Hill Street between John Ian Wing Parade and ~150 metres north)
Footpath width	<ul style="list-style-type: none"> Parramatta Road and Hill Road intersection – may vary up to a maximum of 3.5 metres wide John Ian Wing Parade – may vary up to a maximum of 4.0 metres wide
Shared path width	<ul style="list-style-type: none"> Hill Road – 4.0 metres
Road grade	<ul style="list-style-type: none"> Hill Road: 0.3% - 1.6% John Ian Wing Parade: 1.1% - 1.4% Stockyard Boulevard: 1.8% - 4.5%
Drainage	<ul style="list-style-type: none"> West side of Parramatta Road and Hill Road intersection: drainage pipe and open channel Drainage pipe along median and east side of Hill Road Hill Road and Carter Street intersection: drainage pipe Hill Road and John Ian Wing Parade intersection: drainage pipe on northern side Hill Road and Stockyard Boulevard: drainage pipe on north and south ends
Landscaping	<ul style="list-style-type: none"> Existing vegetation: <ul style="list-style-type: none"> adjacent to Haslam's Marker along John Ian Wing Parade alongside footpath near the M4 on ramp along Parramatta Road along roadside near Birnie Avenue

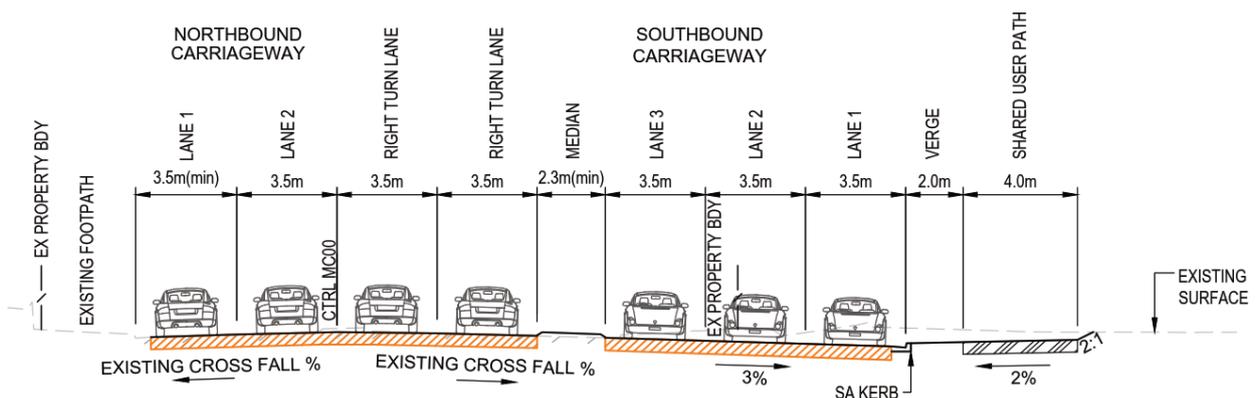


Figure 3-2: Proposed Hill Road (section view)

3.2.2 Engineering constraints

The Proposal exists in an urbanised environment with high demand roads due to existing and future residences as well as proximity to Sydney Olympic Park. Key engineering constraints relating to the Proposal include:

- minimising constructability issues without having a major impact on motorway operations
- relieving congestion and improving travel times into the Sydney Olympic Park by providing additional network capacity and functionality
- reducing environmental ecological impacts on an area of protected remnant woodland south of the M4 Motorway near the Hill Road and Parramatta Road intersection by removing the secondary construction compound and minimising the left-turn lane width
- minimising the number of property acquisitions required for the Proposal
- designing suitable single and dual turning movements for B-doubles
- avoiding potential public utilities within the Proposal which cannot be readily relocated
- enhancing active transport in a constrained area due to the M4 Motorway bridge piers and the required path width
- designing the Proposal to be compatible with the existing drainage of the roads
- supporting the development of the strategic growth areas.

3.2.3 Major design features

Major design feature 1 – Upgrading Hill Road

In the northbound direction, Hill Road would be upgraded over a distance of 700 metres between Parramatta Road and John Ian Wing Parade. The northbound section between Parramatta Road and the M4 eastbound exit off ramp will be opened up from one to two lanes by signalling the exit of the M4 eastbound off ramp. The section between the exit of the M4 eastbound off ramp and Carter Street would be line marked as two travel through lanes between Carter Street and John Ian Wing Parade and removing the right turn movement into Carter Street. Hill Road would be widened to accommodate two additional right turn lanes into the Carter Street Precinct at the intersection at John Ian Wing Parade and Stockyard Boulevard – the new road that accesses the Carter Street Precinct.

In the southbound direction, Hill Road would be upgraded to include three southbound lanes through the intersection at John Ian Wing where it would meet the existing three lane section of Hill Road. The existing shared user path would be relocated and widened between Parramatta Road and Carter Street, and a new SUP would be provided for cyclists and pedestrians on the eastern side between Carter Street and John Ian Wing Parade as shown in Figure 3-3.

The upgrade of the existing SUP between Parramatta Road and Carter Street and the provision of a new shared user path along the eastern side between Carter Street and John Ian Wing Parade is proposed to enhance pedestrian and cyclist connectivity to the Sydney Olympic Park precinct. The SUP would travel from Parramatta Road to Carter Street on the western side of Hill Road where it would connect to an existing SUP continuing on to John Ian Wing Parade towards the Sydney Olympic Park.

Major design feature 2 – Modifying Parramatta Road and Hill Road intersection

Upgrades for Parramatta Road would include a dedicated left turn only lane onto the northbound side of Hill Road. This access would connect eastbound side traffic from Parramatta Road to the northbound side of the Hill Road.

In addition, the upgrade would improve and widen the footpath along Parramatta Road and Hill Road (northbound) as shown in Figure 3-3.

Major design feature 3 – Widening Bombay Street

Bombay Street would be reconfigured to make better use of the available space to include an additional northbound lane including a dedicated right turn, left turn and through lanes at the Parramatta Road intersection as shown in Figure 3-3. Kerb adjustments would be undertaken at the southern east corner to improve the turning radius.

Major design feature 4 – Converting the Carter Street intersection

The existing T-intersection at Carter Street would be converted to a left-in, left-out intersection as shown in Figure 3-3. Right turn movements by motorists at this intersection would be prevented to allow for two through lanes northbound to be provided. In addition, the intersection would include installation of a median and maintaining the existing two through lanes northbound on Hill Road.

Major design feature 5 – Upgrading the intersection at John Ian Wing Parade

The upgraded intersection will provide additional access to the new Carter Street Precinct with an additional road on the eastern side of Hill Road creating a four-way from a three-way intersection as shown in Figure 3-3.

The road access to the eastern side of Hill Road through the centre of the Carter Street Precinct is named Stockyard Boulevard. The revised John Ian Wing Parade intersection would allow for dual right turning lanes access into Stockyard Boulevard from the northbound side of Hill Road. In addition, the intersection would include two northbound lanes on Hill Road and three southbound lanes.

The eastbound side of this intersection would include a new three-metre wide shared footpath and connect with the existing footpath and SUP to Stockyard Boulevard.

Major design feature 6 – Kerb adjustment on Birnie Avenue and Parramatta Road intersection

In order to accommodate a B-Double left turn movement from eastbound carriageway of Parramatta Road to northbound carriageway of Birnie Avenue, a kerb adjustment is required on the northwest corner of the Birnie Avenue and Parramatta Road intersection. The existing footpath at this location would be reinstated once the construction of the kerb widening is completed.

The signalised pedestrian crossing arrangements on Birnie Avenue near to this intersection would be relocated further north from its current position to maintain safety and street lighting arrangements as shown in Figure 3-4.

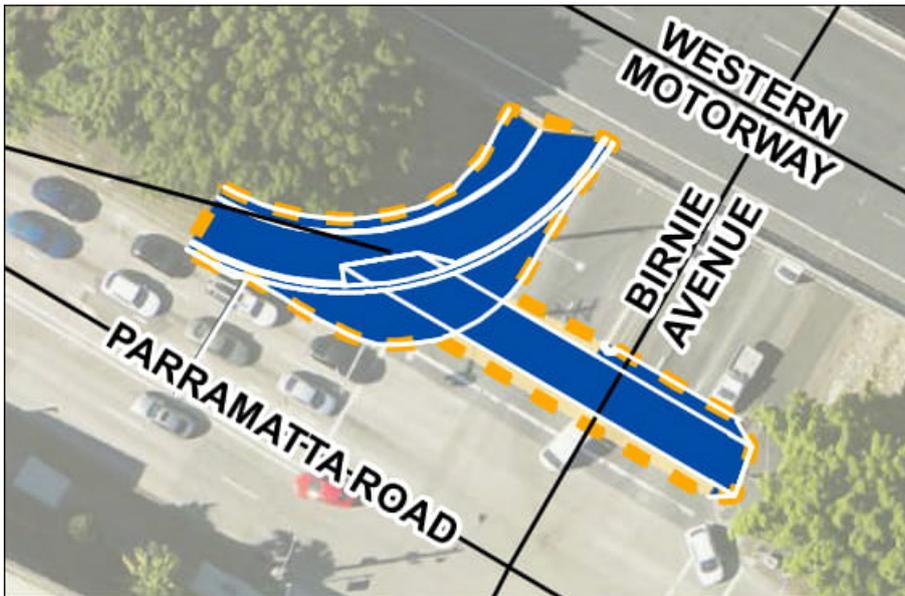


Figure 3-4: Birnie Avenue intersection upgrade

3.2.4 Construction activities

The indicative methodology, staging, work hours, plant and equipment to construct the Proposal are described in this section. Subject to approval, construction is expected to commence in 2023 and take around 18 months to complete.

The construction methodology would be further developed by the nominated Contractor during the detailed design of the Proposal in consultation with Transport for NSW.

The actual construction work methods may vary from the description assessed in this REF due to the identification of additional constraints before work starts, ongoing detailed design refinements, feedback from community and stakeholder consultation, and contractor requirements/limitations.

The Proposal would be built under Transport for NSW construction specifications under a construction environmental management plan (CEMP). The specifications would cover environmental performance and management including vegetation removal, stockpile management and erosion and sediment control.

The proposed construction activities for the Proposal are identified in Table 3-2. This staging is indicative and is based on the current concept design and subject to change once the detailed design methods is finalised.

Table 3-2: Proposed construction work methodology

Proposed works	Indicative timing
Early works	
<ul style="list-style-type: none"> Demolition of buildings at the John Ian Wing Parade and Stockyard Boulevard intersection 	Day and Night Works
<ul style="list-style-type: none"> Placing concrete barrier along Hill Road near M4 Motorway ramp 	Night Works
<ul style="list-style-type: none"> Relocation of existing utilities underneath M4 Motorway overpass on Hill Road 	Day and Night Works
<ul style="list-style-type: none"> Construction of M4 Motorway bridge pier protection 	Day and Night Works
<ul style="list-style-type: none"> Construction of a SUP underneath M4 Motorway overpass on Hill Road toward Stockyard Boulevard and John Ian Wing Parade intersection 	Day and Night Works
<ul style="list-style-type: none"> Removal of existing medians on Hill Road 	Night Works
<ul style="list-style-type: none"> Removal of vegetation 	Day Works
<ul style="list-style-type: none"> Reconfiguration of traffic lights at Hill Road and John Ian Wing Parade intersection for construction vehicles to access site compound 	Day and Night Works
<ul style="list-style-type: none"> Construction of site compound adjacent to eastern section of John Ian Wing Parade 	Day Works
<ul style="list-style-type: none"> Construction of temporary pavement for vehicle access into site compound 	Day and Night Works
Stage 1	
<ul style="list-style-type: none"> Intersection adjustments at Birnie Avenue and Parramatta Road intersection upgrade including: <ul style="list-style-type: none"> median and lane marking changes to be night works under traffic control. northern pedestrian crossing on Birnie Avenue at the intersection with Parramatta Road to be closed during construction for pedestrian safety and minimising works under traffic control. Alternate pedestrian access to Carter Street via Edward Flack Avenue crossing. retaining wall 	Day and Night Works
<ul style="list-style-type: none"> Widening and upgrade of Hill Road and Parramatta Road intersection, including decommissioning of the existing footpath under Hill Road and M4 Motorway overpass. Construction of proposed northbound Hill Road lane Construction of retaining wall under the M4 Motorway on the western side of Hill Road. 	Day and Night Works
<ul style="list-style-type: none"> Widening of Bombay Street for additional through northbound lane, dedicated right turn and left turn lanes 	Night Works
<ul style="list-style-type: none"> Widening of M4 Motorway eastbound off ramp onto Hill Road Traffic to be protected with temporary barriers and diverted into a single lane exit onto Hill Road. Pedestrian crossing to be maintained with construction under live pedestrian traffic 	Day and Night Works
<ul style="list-style-type: none"> Temporary line marking on Hill Road to provide two lanes north bound and two lanes southbound 	Day and Night Works

Proposed works	Indicative timing
<ul style="list-style-type: none"> Widening of Hill Road and Carter Street intersection 	Day and Night Works under traffic control
<ul style="list-style-type: none"> Widening of Hill Road – construction of new pavement for three lanes of southbound carriageway, utility relocation works and drainage works 	Day Works under traffic control
<ul style="list-style-type: none"> Intersection improvements at John Ian Wing Parade eastbound, two new left turn lanes and widening of intersection 	Day and Night Works
<ul style="list-style-type: none"> Construction of the stub for Stockyard Boulevard 	Day Works
Stage 2	
<ul style="list-style-type: none"> Construction of two nearside lanes northbound lanes on Hill Road Construction of remaining widening works of M4 Motorway eastbound off ramp onto Hill Road and installation of traffic signals 	Day Works – under traffic control for property access
<ul style="list-style-type: none"> John Ian Wing Parade including pavement median construction 	Day Works
<ul style="list-style-type: none"> Hill Road and John Ian Wing Parade intersection widening 	Night Works under traffic control
Stage 3	
<ul style="list-style-type: none"> Construction of Hill Road raised medians to ultimate state 	Day and Night Works
<ul style="list-style-type: none"> Signals installed at eastbound on ramp and Hill Road intersection 	Day and Night Works
<ul style="list-style-type: none"> Finalisation of John Ian Wing Parade and Hill Road intersection works with final asphalt (is this right? Help the community understand) wearing course and line marking 	Night Works under traffic control

3.2.5 Construction workforce

The assumed construction workforce for this Proposal would include an average workforce of 75 workers and at its peak 125 workers over the 18-month construction phase.

3.2.6 Construction hours and duration

Most of the works required for the Proposal would be undertaken during recommended standard (NSW) Environment Protection Authority (EPA) construction hours, which are as follows:

- 7.00 am to 6.00 pm Monday to Friday
- 8.00 am to 1.00 pm Saturdays
- No work on Sundays or public holidays.

Certain works may need to occur outside recommended standard hours and may include the following:

- placing concrete barriers
- relocating of existing utilities
- construction of shared user path and bridge pier protection
- removal of existing median on Hill Road
- modifications of Birnie Avenue and Parramatta Road intersection (median and lane marking changes)
- widening of Hill Road and Carter Street intersection
- intersection improvements at John Ian Wing Parade eastbound

- widening of Hill Road and John Ian Wing Parade intersection
- traffic switching on Hill Road and pavement refurbishment work
- finalisation of Hill Road and John Ian Wing Parade intersection works
- demolition of buildings at the John Ian Wing Parade and Stockyard Boulevard intersection
- removal of street trees, if required.

Approval from Transport for NSW would be required for any out of hours work and the impacted community would be notified at least 7 days' notice, as outlined in Roads and Maritime's *Construction Noise Strategy* (refer to Chapter 6 for further details).

3.2.7 Plant and equipment

An indicative list of plant and equipment that would be required to construct the Proposal is provided in Table 3-3. Additional plant and equipment likely to be used would be identified during detailed design by the nominated Contractor.

Table 3-3: Proposed plant and equipment

Equipment	
Asphalt milling machine	Hydro mulching equipment
Bobcat	Jackhammer
Chainsaw	Paving machine
Concrete pump	Piling rig (bored)
Concrete saw	Piling rig (vibratory)
Concrete truck/agitator	Semi-trailer
Excavator (12 tonne)	Smooth drum roller
Excavator (20 tonne)	Truck (10 tonne)
Excavator (breaker)	Medium sized vibratory roller
Grader	Small sized vibratory roller
Asphalt milling machine	Hydro mulching equipment
Franna crane	Mobile Hydraulic telescopic crane

3.2.8 Earthworks and materials

Table 3-4 summarises the estimated volumes of earthworks required for the construction of the Proposal. Earthworks and estimated quantities would be further refined prior to the start of construction during detailed design.

Table 3-4: Summary of earthworks and estimated volume

Earthworks	Estimated volume (m ³)
Excavation cut (including existing road material (pavement asphalt, and sub-base)	3,950
Fill	2,450
Cut/fill balance	1,505

Table 3-5 summarises the materials and quantities needed to construct the Proposal:

Table 3-5: Summary of materials and estimated volumes

Material	Estimated volume (m ²)
Asphalt and base and sub-base pavement materials (stone, aggregate, quarried materials)	16,000
Kerbing	2,800
Concrete culverts, pipes, pits and drain to build the stormwater infrastructure	To be confirmed during detailed design
Prefabricated signage, lighting posts, and fencing	
Trees, seedlings, chippings and turf to support revegetation	
Additional materials such as relatively small quantities of paint, oils, fuels and other materials.	

3.2.9 Source of materials

Materials would be sourced from local areas where practicable. The ability to reuse the material would depend on its physical and chemical properties. Material unsuitable for construction would be managed in accordance with resource management hierarchy principles, including (in order of preference):

- reused as engineered fill onsite
- transferred:
 - to another Transport for NSW project for reuse in accordance with the NSW Environment Protection Authority (EPA) Excavated Public Road Material resource recovery exemption
 - to an approved Transport for NSW stockpile site for future re-use, only if a specific project has been identified before stockpiling and the Protection of the Environment Operations Act 1997 (POEO Act) waste regulatory requirements have been met. If a project cannot be identified the material would not be stockpiled within the Proposal
 - off site for reuse by a third party in accordance with a relevant EPA Excavated Public Road Material resource recovery exemption or relevant planning approval
 - to a licenced waste recovery site
 - for disposal at a licenced facility
 - as otherwise provided for by the relevant waste legislation.

Natural resources required for construction of the Proposal would include aggregates and sand for use in concrete. The type of aggregate and sand would be specified by concrete designers during detailed design. Pavement materials may include heavily bound sub-base and asphalt concrete. Manufactured items, including structural steel and precast concrete components would also be required.

Materials would be sourced from appropriately licensed facilities. Wherever possible, materials would be sourced from commercial suppliers in nearby areas or other viable sources such as other nearby infrastructure planning proposals. No materials currently proposed to be used for the Proposal are considered to be in short supply.

If additional fill material is required, that cannot be sourced from within the construction footprint, it would be imported from a suitably licensed nearby quarry. Surplus material that cannot be used

within the construction footprint would be reused on other projects or disposed of in the order of priority as outlined in Section 3.2.8.

3.2.10 Traffic management and access

Vehicle movements

Traffic generated by construction activities includes construction worker light vehicles, as well as heavy vehicles for periodic delivery and removal of materials, and construction plant and equipment.

The traffic generated as part of the construction works is not expected to exceed 100 light vehicles and 100 heavy vehicles per day during peak construction periods as summarised in Table 3-6.

Table 3-6: Vehicle movements during construction of the Proposal

Vehicle type and association	Vehicle number		Typical travel patterns and limitations
	Average	Maximum	
Standard hours			
Construction traffic including waste and spoilt vehicles: heavy vehicles up to 40 tonnes	50	100	Regular movements throughout the day (7am to 6pm)
Deliveries: light and heavy commercial vehicles up to 5 tonnes	10	50	Outside of peak periods (10am to 3pm). Parking within the main compound site.
Workers: cars	50	100	On the fringes of the peak periods (6am to 7am and 4pm to 5pm)
Out of hours			
Construction traffic: heavy vehicles up to 40 tonnes	20	30	Early evening where possible (6pm to 10pm)

Haulage routes

Identified haulage routes to access the Proposal are below and shown in Figure 3-5:

- the M4 Motorway and Parramatta Road to enter and leave the Proposal
- Hill Road, Holker Street and Silverwater Road to enter and leave the construction compound
- vehicles would exit at the Homebush Bay Drive interchange and travel along Parramatta Road to Hill Road.

Road and lane access/closures

Traffic and transport impacts associated with the Proposal are assessed in Section 6.5 of this REF. Traffic delays and access may occur as a result of the Proposal's construction and be managed in the Traffic Management Plan (TMP). The potential traffic and access impacts expected during the construction of the Proposal include:

- temporary increased traffic delays from the movement of construction vehicles and hauling of materials
- public transport impacts on bus routes 401, 525 and 526 to be rerouted

- temporary loss of on-road cycle lanes on John Ian Wing Parade and Old Link Road.

The impact of construction worker vehicle parking would be managed through measures identified in the TMP.

Traffic management, control and signage

Where possible, construction activities would be programmed to minimise the impact on traffic using the local and regional road network.

Standard traffic management measures would be used to minimise the traffic impact expected during construction. These measures would be identified in a TMP for the Proposal and would be developed in accordance with the Transport for NSW's *Traffic Control at Work Sites Manual* (Roads and Maritime 2018) and Transport for NSW *Specification G10 - Traffic Management* (Roads and Maritime, 2015).

Detailed construction methods and associated management plans (such as Traffic Control Plans (TCPs)) and a CEMP would also be developed of the Proposal to manage potential traffic and access impacts.

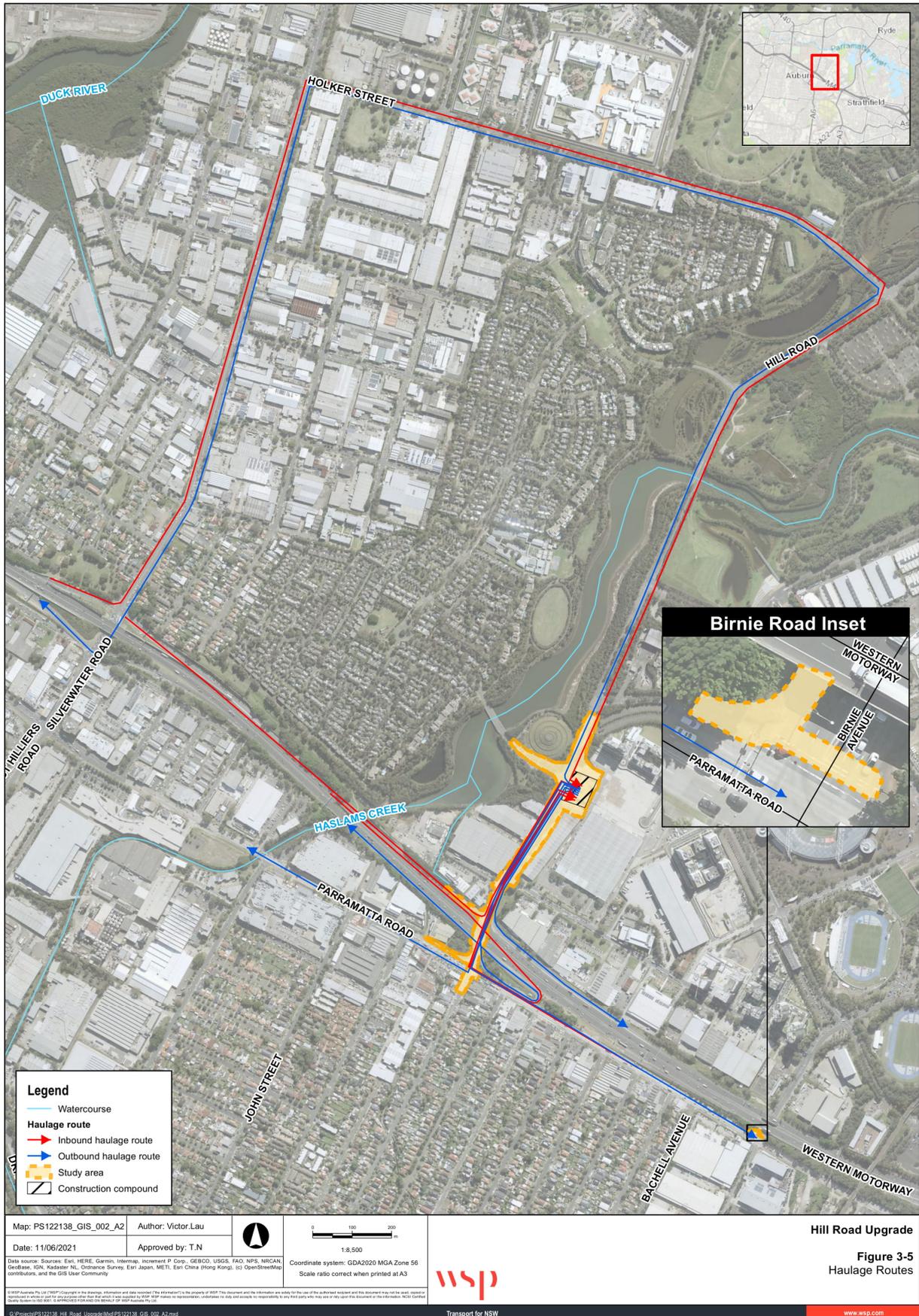


Figure 3-5: Haulage routes

3.3 Ancillary facilities

A temporary construction compound would be required to accommodate a site office, amenities, laydown and storage area for materials. The temporary construction compound would be located on the northern side of the Proposal near the Hill Road and John Ian Wing Parade intersection as shown in Figure 3-6. The compound is a Mixed Use land (Lot 302/DP541070). During construction of the Proposal, a full acquisition (8,357 square metres) of the lot would be required; however, at the completion of the Proposal, 3,757 square metres would be returned to City of Parramatta Council after works are completed. Refer to Section 3.5 for further details on property and land acquisition.

No parking would be affected by ancillary facilities nor would there be any other storage/laydown areas required for the Proposal.

Ancillary facilities would be selected during detailed design. Where it is not feasible to achieve all the principles, environmental mitigations and safeguards would be implemented as noted in Chapter 7.

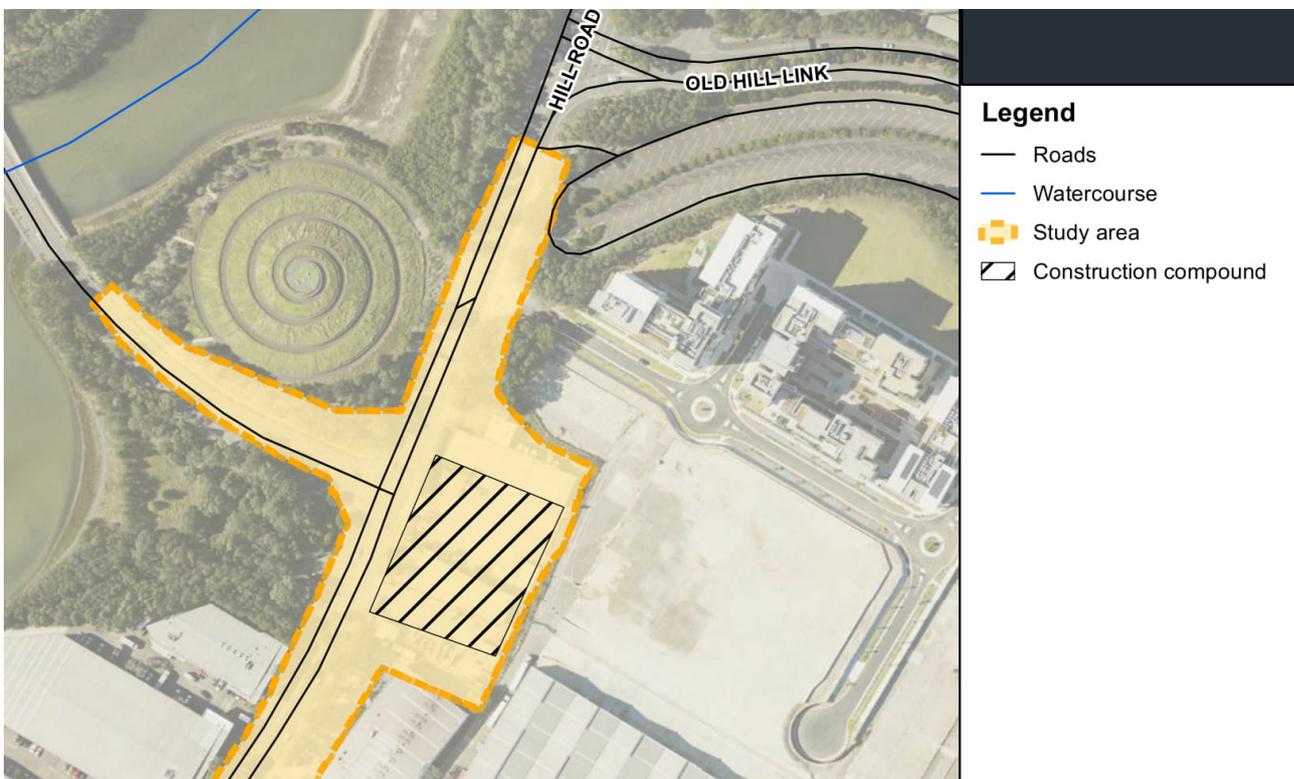


Figure 3-6: Location of construction compound

3.4 Public utility adjustment

Table 3-7 summarises the utility adjustments related to the Proposal.

Table 3-7: Public utility adjustment related to the Proposal

Location	Utility and location	Action
Hill Road Parramatta to Carter Street	High pressure oil, crossing Hill Road	None
	Jet fuel, crossing Hill Road	None
	Electrical transmission, crossing Hill Road	Adjust
	High pressure gas, crossing Hill Road	Protect
	Ethylene, crossing Hill Road	None
	Electrical distribution, western side of Hill Road	Relocate
	Telecommunications, western side of Hill Road and crossing Hill Road	Relocate
	Water, western side of Hill Road.	Relocate
Hill Road from Carter Street to John Ian Wing Parade	Sewer, eastern side of Hill Road and crossing Hill Road	Relocate
	Electrical distribution, eastern side of Hill Road and crossing Hill Road	Relocate
	Telecommunications, eastern side of Hill Road	Relocate
	Water, eastern side of Hill Road and crossing Hill Road.	Relocate
John Ian Wing Parade intersection to northern limit of work	Electrical distribution, both sides of Hill Road and crossing Hill Road	Relocate
	Sewer, eastern side of Hill Road	Relocate
	Telecommunications, both sides of Hill Road, crossing Hill Road and on the northern side of John Ian Wing Parade	Relocate
	Water, both sides of Hill Road, crossing Hill Road and on the northern side of John Ian Wing Parade.	Relocate

3.5 Property acquisition

Table 3-8 describes the proposed property and land acquisitions for the Proposal. During detailed design the nominated Contractor would investigate ways to minimise impacts to these properties and/or to potentially retain them. Figure 3-7 shows the properties identified for acquisition.

Table 3-8: Proposed property acquisition

Lot and DP	Acquisition type	Acquisition area (m ²)	Land use zone (LEP)	Purpose
Lot 1 DP747776	Partial	320	B6 – Enterprise corridor	Widening of footpath from the intersection of Parramatta Road and Hill Road
Lot 23 DP12474	Partial	85	B6 – Enterprise corridor	Widening of Bombay Street and Parramatta Road intersection for additional turn lanes
Lot 71 DP1191648	Partial	450	E2 – Environmental management	Road reserve for widening of Hill Road northbound and John Ian Wing Parade intersection
Lot 9003 DP1105596	Partial	200	E3 – Environmental management	For new Hill Road and John Ian Wing Parade intersection, widened footpath and road upgrades
Lot 3020 DP879226	Partial	590	E3 – Environmental management	
Lot 103 DP1191651	Partial	790	IN1 – General industrial	Road reserve for widening of Hill Road, construction compound, new SUP and new Stockyard Boulevard stub.
Lot 302 DP541070	Full	8,357	B4 – Mixed use	
Lot 301 DP541070	Partial	2,941	R4 – High density residential	Includes acquiring four commercial properties. Residual area of Lot 302 would be transferred to City of Parramatta Council after completion of works



Figure 3-7: Property acquisition for the Proposal

4. Statutory and planning framework

This chapter provides the statutory and planning framework for the Proposal and considers the provisions of related state environmental planning policies, Local Environmental Plans (LEP) and other legislation.

4.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the system of environmental planning and assessment in NSW. This Proposal is subject to the environmental impact assessment and planning approval requirements of Division 5.1 of the EP&A Act. Division 5.1 specifies the environmental impact assessment requirements for activities undertaken by public authorities, such as Transport for NSW, which do not require development consent under Part 4 of the Act.

In accordance with Section 5.5 of the EP&A Act, Transport for NSW, as the proponent and determining authority, must examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the Proposal.

Clause 228 of the *Environment Planning and Assessment Regulation 2000* (EP&A Regulation) prescribes the minimum factors which must be considered when determining if an activity assessed under Division 5.1 of the EP&A Act has or is likely to have a significant effect on the environment. Chapter 6 of the REF provides an environmental impact assessment of the Proposal in accordance with clause 228 and Appendix B specifically responds to the factors for consideration under clause 228.

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 or road infrastructure facilities and is to be carried out by Transport for NSW, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. Development consent from Council (Parramatta Council and Cumberland Council) is not required.

The Proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* and does not require development consent or approval under State Environmental Planning Policy (Coastal Management) 2018, State Environmental Planning Policy (State and Regional Development) 2011 or State Environmental Planning Policy (State Significant Precincts) 2005.

Part 2 Division 1 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.

Clause 8 of the ISEPP identifies that the ISEPP prevails over all other environmental planning instruments, except where there is an inconsistency with State Environmental Planning Policy (State Significant Precincts) 2005 or certain provisions of State Environmental Planning Policy (Coastal Management) 2018.

State Environmental Planning Policy (State Significant Precincts) 2005

The State Significant Precincts SEPP identifies State Significant precincts, which are areas with state or regional planning significance, and provides planning pathways and controls for those precincts.

Sydney Olympic Park is considered as a State Significant Precinct under Appendix 11 of the SEPP. Therefore, the planning provisions prescribed by the State Significant Precincts SEPP are in place of a Local Environmental Plan (in this case the Auburn Local Environmental Plan 2010).

The Proposal is located within an area zoned under the State Significant Precincts SEPP as B4 Mixed Use and E3 Environmental Management.

Table 4-1 includes the details of the provisions relating to development within the B4 Mixed Use and E3 Environmental Management. However, Clause (17) in Appendix 11 of the State Significant Precincts SEPP provides that:

“This Appendix does not restrict or prohibit, or enable the restriction or prohibition of, the carrying out of any development that is permitted to be carried out with or without consent or that is exempt development under State Environmental Planning Policy (Infrastructure) 2007.”

As the Proposal is permissible without development consent under ISEPP, the State Significant Precincts SEPP would not apply; however, the provisions have been considered in the preparation of this REF.

Table 4-1: Relevant zones under the State Significant Precincts SEPP

Zone	Relevant provision details
B4 Mixed Use	<p>The objectives of zone B4 Mixed Use include:</p> <ul style="list-style-type: none"> • to protect and promote the major events capability of the Sydney Olympic Park site and to ensure that it becomes a premium destination for major events • to integrate suitable business, office, residential, retail and other development in accessible locations so as to maximise public transport patronage and encourage walking and cycling • to ensure that the Sydney Olympic Park site becomes an active and vibrant town centre within metropolitan Sydney • to provide for a mixture of compatible land uses • to encourage diverse employment opportunities • to promote ecologically sustainable development (ESD) and minimise any adverse effect of land uses on the environment • to encourage the provision and maintenance of affordable housing. <p>The Proposal is consistent with the objectives of zone B4 as it would provide upgrade road related infrastructure, to improve travel times and connectivity to the Sydney Olympic Park, to support the future mixture of business, office, residential, retail and other development as well as to enhance active transport in the area.</p>

Zone	Relevant provision details
E3 Environmental Management	<p>The objectives of zone E3 Environmental Management include:</p> <ul style="list-style-type: none"> to protect, manage and restore areas of special ecological, scientific, cultural or aesthetic values to provide for a limited range of development that does not have an adverse effect on those values to assist in giving effect to the Parklands Plan of Management to support the capability of the Sydney Olympic Park site as a premium destination for major events. <p>The Proposal is consistent with the objectives of zone E3 as it avoids ecologically sensitive areas (e.g. woodland grass) located on the south end of the Proposal and provides a reliable and improved road for connection to the Sydney Olympic Park.</p>

State Environmental Planning Policy (State and Regional Development) 2011

State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) provides that development is 'State Significant Development' and would require approval from the Minister from Department of Planning, Industry and Environment under Part 4 of the EP&A Act if:

- the development on the land requires development consent under Part 4 of the Act
- the development has a capital investment value of more than \$10 million on land identified as being within the 'Sydney Olympic Park site'.

The proposed Hill Road upgrade is permitted without development consent under ISEPP. The proposed works identified being within the 'Sydney Olympic Park site' has a capital investment value of less than \$10 million. Therefore, the Proposal does not trigger the State Significant Development provisions of the SRD SEPP.

State Environmental Planning Policy 55 - Remediation of Land

This SEPP requires consent authorities to consider whether the site is or is likely to be contaminated and determines categories of remediation requiring consent. Consent is not required because the works may be carried out without consent under ISEPP. Section 6.4 contains an assessment of the likelihood of contamination in the study area.

State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017

This SEPP applies as it is in an area listed in Clause 5.1a and land within the zones listed in Clause 5.1b. As the works are permissible without consent under the Infrastructure SEPP, a Council permit to clear vegetation under this SEPP is not required.

State Environmental Planning Policy No 19 – Bushland in Urban Areas

This SEPP's aim is to protect and preserve bushland within the urban areas with identified areas of Schedule 1. None of the identified areas in Schedule 1 of this SEPP are within the Proposal.

Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005 (SREP 2005)

The SREP 2005 provides a set of clear planning principles for land within the Sydney Harbour Catchment, Foreshores and Waterways Areas and Heritage Conservation areas. The Proposal is located within Sydney Harbour Catchment land and is subject to Sydney Harbour Catchment land planning principles provided in Part 2 of the SREP. As the Proposal is not located within the harbour, planning principles of the Sydney Harbour SREP are not directly applicable and have not been further discussed.

In addition, the Proposal is not located within the Foreshores and Waterways Area as defined under the SREP.

4.1.2 Local Environmental Plans

The Proposal is permissible without development consent under ISEPP and provision of Local Environmental Plans would not formally apply. However, for the purposes of this REF they were included for reference and discussed below.

Auburn Local Environmental Plan 2010

The Proposal is located within the City of Parramatta LGA and Cumberland LGA and development within these two LGAs are regulated by the Auburn Local Environmental Plan 2010 (LEP). The Proposal is located within the following land use zones under the Auburn LEP:

- SP2 Infrastructure
- B6 Enterprise Corridor
- R4 High Density Residential

The objectives of these land use zonings are discussed in Table 4-2 and shown in Figure 4-1.

Table 4-2: Auburn LEP zoning and provision details

Zone	Relevant provision details
SP2 Infrastructure	<p>The objectives of zone SP2 include:</p> <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 • to ensure that development does not have an adverse impact on the form and scale of the surrounding neighbourhood. <p>The Proposal is consistent with the objectives of zone SP2 as it would provide upgraded road related infrastructure, to improve travel times, safety within the area and improved connectivity.</p>
B6 Enterprise Corridor	<p>The objectives of zone B6 include:</p> <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. <p>The Proposal is consistent with the objectives of zone B6 as it would provide an upgraded road and connection to existing and future development (e.g. business, office, retail and light industrial uses).</p>

Zone	Relevant provision details
R4 High Density Residential	<p>The objectives of zone R4 include:</p> <ul style="list-style-type: none"> • to provide for the housing needs of the community within a high-density residential environment • to provide a variety of housing types within a high-density residential environment • to enable other land uses that provide facilities or services to meet the day to day needs of residents • to encourage high density residential development in close proximity to bus service nodes and railway stations. <p>The Proposal is consistent with the objectives of zone R4 as it would provide upgraded road related infrastructure to support the future residential development of the area and support the Carter Street Precinct Plan.</p>

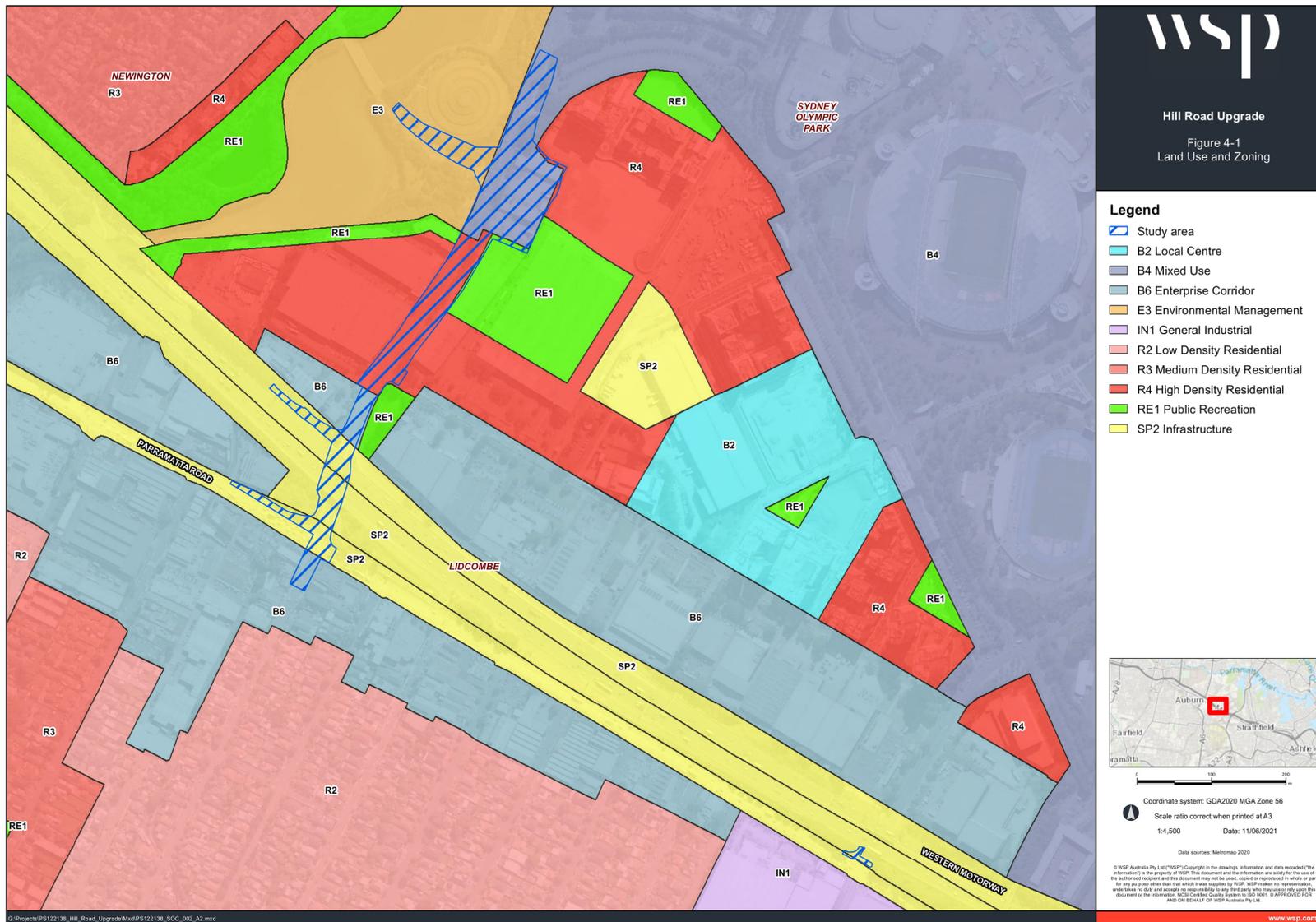


Figure 4-1: Land use and zoning of the Proposal

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 clause 35, Schedule 1 - road construction (meaning the construction or widening of roads) is relevant to the Proposal.

Road construction is a scheduled activity under Schedule 1 of the POEO Act if it results in four or more traffic lanes (not including bicycle lanes or lanes used for entry or exit), where the road is classified or proposed to be classified as a main road for at least three kilometres of its length in the metropolitan area.

Based on the concept design and construction methodologies proposed (refer to Section 3.2.5) an Environment Protection Licence (EPL) would not be required as the Proposal would involve upgrading about 700 metres of Hill Road and widening up to a three-lane road on the southbound roadway.

4.2.2 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) provides for the conservation of buildings, works, archaeological, relics and places of heritage value. It principally achieves this by listing, and therefore protecting, heritage values under a number of registers. This includes the State Heritage Register (SHR), the Heritage and Conservation Register (HCR), LEP heritage schedules, public authority heritage and conservation registers, termed section 170 registers, and interim Heritage Orders (IHOs).

The Heritage Act requires Transport for NSW to assess the Proposal's impact on historic buildings, places, objects, works, relics and archaeological sites, and to ensure their cultural heritage value is protected. Refer to Section 6.8 and Appendix I for more detail.

The Heritage Act sets out provisions that require a heritage impact assessment to be prepared where the Proposal has the potential to impact on any values that are protected under the Heritage Act. Finally, the Heritage Act sets out a process for obtaining permission from the NSW Heritage Council, as administrators of the Heritage Act, to investigate, excavate and/or impact on a heritage-listed item.

The Proposal would have minor impacts and not expected to require further approval under the Heritage Act prior to works commencing. Impacts to heritage items are discussed further in Section 6.8.

4.2.3 National Parks and Wildlife Act 1979

There is no reserved land under the *National Parks and Wildlife Act 1997* (NPW Act) within the Proposal. The harming or desecrating of Aboriginal objects or places is an offence under section 86 of the NPW Act. Under section 90, an Aboriginal heritage impact permit may be issued in relation to a specified Aboriginal object, Aboriginal place, land, activity or person or specified types or classes of Aboriginal objects, Aboriginal places, land, activities or persons.

The Office of Environment and Heritage (OEH) has published the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (Department of Environment, Climate Change and Water (DECCW), 2010).

4.2.4 Roads Act 1993

Section 138 of the *Roads Act 1993* (Roads Act) requires consent from the relevant road authority for the carrying out of work in, on or over a public road. However, clause 5(1) in Schedule 2 of the Roads Act states that public authorities do not require approval for works on unclassified roads.

The Proposal would involve work on Parramatta Road and Hill Road which are both classified roads under the Roads Act. The Proposal also includes work on local roads including Bombay Street, Birnie Avenue and Carter Street. A road occupancy licence may be required and obtained under Section 138 of the Roads Act in order to perform works for the Proposal. Where works are required that would impact on local roads of the Proposal, ongoing consultation with Cumberland Council or City of Parramatta Council would occur, as required.

4.2.5 Crown Lands Management Act 2016

The *Crown Lands Management Act 2016* (Crown Lands Act) replaces the *Crown Lands Act 1989* from 1 July 2018. The Crown Lands Act is intended to ensure that Crown land is managed for the benefit of the people of NSW and to provide for the proper assessment and management of Crown land in accordance with the principles of the Act. The Act sets out the conditions under which Crown land is permitted to be occupied, used, sold, leased, licensed or otherwise dealt with.

There are no identified Crown land within the Proposal.

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 D 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 D.

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 Agriculture, Water and the Environment 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.

4.3.2 Aboriginal and Torres Strait Islander Heritage Protection Act 1984

There is an obligation on a person who discovers anything which he or she has reasonable grounds to suspect are Aboriginal remains to report that discovery to the Minister, giving particulars of the remains and their location. The Proposal does not include any previously identified Aboriginal sites and/or places (refer Section 6.7); however, considerations for unexpected finds further detailed in mitigation measures and applies to this Act.

4.3.3 Native Title Act 1993

The *Native Title Act 1993* recognises and protects native title. The Act covers actions affecting native title and the processes for determining whether native title exists and compensation for actions affecting native title. It establishes the Native Title Registrar, the National Native Title Tribunal, the Register of Native Title Claims and the Register of Indigenous Land Use Agreements, and the National Native Title Register. Under the Act a future act includes proposed public infrastructure on land or waters that affects native title rights or interest. A search of the Native Title Tribunal Native Title Vision website was undertaken, with no Native Title holders/claimants identified. If Native Title holder/claimants are identified in further development and design of the Proposal, Transport for NSW would provide a notice of the Proposal to NTSCORP under section 24KA of the Act and would be invited to comment on the Proposal.

4.4 Ecologically sustainable development

Transport for NSW is committed to ensuring that its projects are implemented in a manner that is consistent with the principles of ecologically sustainable development (ESD). The principles of ESD are generally defined under the provisions of clause 7(4) of Schedule 2 to the EP&A Regulation as:

- the precautionary principle – if there are threats of serious or irreversible damage, a lack of full scientific uncertainty should not be used as a reason for postponing measures to prevent environmental degradation
- intergenerational equity – the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations
- conservation of biological diversity and ecological integrity – the diversity of genes, species, populations and their communities, as well as the ecosystems and habitats they belong to, should be maintained or improved to ensure their survival
- improved valuation, pricing and incentive mechanisms – environmental factors should be included in the valuation of assets and services.

The principles of ESD have been adopted by Transport for NSW throughout the development and assessment of the Proposal.

4.5 Confirmation of statutory position

The Proposal is categorised as development for the purpose of a road and/or road infrastructure facilities and is being carried out by or on behalf of a public authority. Under clause 94 of ISEPP the Proposal is permissible without consent. The Proposal is not State significant infrastructure or State significant development. The Proposal can be assessed under Division 5.1 of the EP&A Act. Transport for NSW is the determining authority for the Proposal. This REF fulfils Transport for NSW's obligation under section 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

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 Communications Engagement Plan (CEP) has been prepared for the Proposal. The CEP identifies activities for the consultation process involving Transport for NSW, other relevant government agencies, organisations, community representatives and residents.

The objective of the plan is to inform key stakeholders, immediate residents and businesses, road users and the broader community of the Proposal. A number of communication tools have been used to inform the local and broader community, key stakeholders, local and state government. These included:

- a dedicated project website, telephone and email address
- meetings and briefings
- community information sessions
- media coverage
- print and digital communication materials such as flyers, community updates, postcards
- road signage using portable variable message signs (VMS).

The engagement objectives are to:

- engage and inform key stakeholders and the community about the Proposal planning process and timeframes, proposed concept design and environmental impact assessment
- consult with stakeholders and community during the concept design, environmental assessment and formal exhibition phases of the Proposal
- incorporate local participation into planning decisions and outcomes related to the Proposal
- generate awareness of opportunities for feedback, accessible Proposal information and timely problem solving.

5.2 Community involvement

In December 2020, Transport for NSW invited stakeholders and the community to comment on the Proposal through publishing a 'Have your say' Community Notification. The notification was sent to more than 10,000 residents and businesses in Lidcombe, Sydney Olympic Park, Wentworth Point and Newington. Consultation was completed in February 2021 with 31 submissions received.

The key issues raised during the consultation included:

- continued turning access at the John Ian Wing Parade intersection
- insufficient attention to connectivity issues for residents in Wentworth Point and Newington
- the proposed prohibition of the right turn from Hill Road onto Carter Street
- the signalisation of the M4-Hill Road eastbound off ramp
- congestion at the intersection of Hill Road, Parramatta Road and Bombay Street, Lidcombe
- the need for more active transport (pedestrian and cyclist) links

In addition, of the 31 submissions received, six included comments outside the scope of works for the Proposal:

- the use of local streets for short cut 'rat-runs'
- calls for intersection or road improvements in other areas of Sydney Olympic Park, Wentworth Point and Newington
- congestion on other parts of the road network, particularly at the intersection of Homebush Bay Drive and Australia Avenue
- the cancellation of the M4 Motorway Hill Road westbound off ramp
- calls to re-establish disused rail links in the area.

Transport for NSW has referred these comments to other divisions within Transport for NSW, Department of Planning, Infrastructure and Environment and to the City of Parramatta Council.

A copy of the Community Consultation Summary Report on the community feedback received between December 2020 and February 2021 can be found on the Hill Road Upgrade project webpage at <https://roads-waterways.transport.nsw.gov.au/projects/01documents/hill-road-upgrade/hill-road-consultation-report-september-2021.pdf>.

5.3 Aboriginal community involvement

A search for known Aboriginal heritage items in the vicinity of the study area (plus a 200 metre buffer) was undertaken on 20 April 2021 using the Aboriginal Heritage Information Management system (AHIMS) database. The AHIMS search did not identify any known Aboriginal heritage items within or close to the Proposal.

The extensive landscape modification that has occurred across the Proposal suggests that intact evidence of Aboriginal land use is unlikely to occur within the boundaries of the Proposal. Similarly, the high level of disturbance would suggest that the archaeological potential of the area is low. Therefore, it was not considered necessary to undertake specific Aboriginal consultation.

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).

The City of Parramatta Council, Cumberland Council and State Emergency Services (SES) have been consulted about the Proposal as per the requirements of clauses 13, 14 and 15 of ISEPP. Appendix C contains an ISEPP consultation checklist that documents how ISEPP consultation requirements have been considered.

Issues that have been raised as a result of this consultation are outlined below in Table 5-1.

ISEPP letters were distributed on 28 May 2021 with two responses from the City of Parramatta Council and the SES.

Table 5-1: Issues raised through ISEPP consultation

Agency	Issue raised	Response / where addressed in REF
City of Parramatta Council	<p>Prioritising nearby projects to manage the increased congestion and access to nearby suburbs due to increased developments and growing population</p>	<p>Assessment of cumulative impacts of the Proposal and surrounding developments and projects are assessed in Chapter 6. Cumulative impacts are noted as minor with the implementation of mitigation measures summarised in Chapter 7. Ongoing consultation with City of Parramatta Council and other stakeholders on project timing would continue through further project development.</p>
City of Parramatta Council	<p>Safety concern for pedestrians and cyclists for:</p> <ul style="list-style-type: none"> • access the Shared User Paths (SUP) across Hill Road from the east • queuing of vehicles at the M4 eastbound off ramp due to the new signal potentially obstructing the road crossing. 	<p>As detailed in Chapter 3, the upgrade of the existing SUP between Parramatta Road and Carter Street and the provision of a new shared user path along the eastern side between Carter Street and John Ian Wing Parade is proposed to enhance pedestrian and cyclist connectivity to the Sydney Olympic Park precinct.</p> <p>Access from the east side of Hill Road would require pedestrians to cross at Bombay Street and Parramatta Road at the signalised crossing.</p> <p>Based on the traffic assessment, level of service (LOS) assessment for the Proposal at the M4 Motorway eastbound off ramp operates within standards of LOS B and C. Queuing assessment was not included in the assessment. Details of the LOS assessment are detailed in Appendix G.</p>
City of Parramatta Council	<p>Clarification on how the SUP design at John Ian Wing Parade connects to the bike paths on each side of the proposed road east of Hill Road</p>	<p>As detailed in Chapter 3, the upgrade of the existing SUP between Parramatta Road and Carter Street and the provision of a new shared user path along the eastern side between Carter Street and John Ian Wing Parade is proposed to enhance pedestrian and cyclist connectivity to the Sydney Olympic Park precinct. The SUP would travel from Parramatta Road to Carter Street on the western side of Hill Road where it would connect to an existing SUP continuing on to John Ian Wing Parade toward the Sydney Olympic Park.</p>
City of Parramatta Council	<p>Request to include shared paths on Bombay Street and shared lanterns across Parramatta Road allowing cyclists to transition onto the road towards Lidcombe</p>	<p>The Proposal includes scope for the enhancement of existing shared paths as well as the construction of new active transport infrastructure, relative to the widening and upgrading of Hill Road and associated intersections as detailed in Chapter 3. The Proposal is not intended to deliver all active transport links identified in the Carter Street Master Plan and the larger area.</p> <p>The balance of active transport links would be delivered in stages as adjacent developments progress and will be overseen by the City of Parramatta Council.</p>

Agency	Issue raised	Response / where addressed in REF
City of Parramatta Council	Justification for the proposed travel lane arrangements on Hill Road northbound approaching John Ian Wing Parade potentially creating a conflict point and safety concerns due to changing lanes for turning	The Proposal was developed across a set of objectives and development criteria detailed in Section 2.2. The preferred option, Option 2, also considered and assessed with a range of sub-options including number and travel lane arrangements. The Proposal was selected as the preferred option as it achieved the objectives and development criteria including improving road safety and access for all road users. Details are in Section 2.3.
SES	Construction of the Proposal and potential impacts to access of emergency vehicles	Access to emergency vehicles would be maintained during construction of the Proposal with the implementation of a Traffic Management Plan. Further details are provided in Section 6.5.

5.5 Stakeholder consultation

As discussed in Section 5.4, various government agencies including councils have been consulted about the Proposal. For purposes of this REF, consultation with Sydney Olympic Park Authority (SOPA) was not required under ISEPP, however the authority has been informed and engaged as a key stakeholder and beneficiary of the upgrades due to the Park's proximity to the Proposal. SOPA is identified as a statutory body representing the Crown as defined by the *Sydney Olympic Park Authority Act 2001*.

Part of the Proposal is located within the boundary of the Sydney Olympic Park Site listed under the State Environmental Planning Policy (State Significant Precincts) 2005.

Issues that have been raised by SOPA are outlined below in Table 5-2.

Table 5-2: Issues raised through SOPA

Stakeholder	Issue raised	Response / where addressed in REF
Sydney Olympic Park	Lack of grade separated pedestrian crossing	<p>The Proposal was developed across a set of objectives and development criteria detailed in Section 2.2. The preferred option, Option 2, also considered and assessed a two sub-options for pedestrian amenity including upgrades considering markings, signals and an added SUP. Sub-option B was selected as the preferred design as it achieved the objectives and development criteria. Details are in Section 2.3.</p> <p>Further, the Proposal is not intended to deliver all active transport links identified in the Carter Street Master Plan and the larger area.</p> <p>The balance of active transport links would be delivered in stages as adjacent developments progress and will be overseen by the City of Parramatta Council.</p>

Stakeholder	Issue raised	Response / where addressed in REF
	<p>Proposal does not show clear and direct pedestrian and cycle links for the following:</p> <ul style="list-style-type: none"> • between the Hill Road and Carter Street intersection and Hill Road and Parramatta Road intersection to support connectivity to the Parklands • provision of a dedicated cycle lane along Hill Road connecting Parramatta Road with the Parklands and existing residential community south of Parramatta Road. • pedestrian enhancement coordination of the Proposal with the proposed 2019 City of Parramatta bridge feasibility study over Haslams Creek. 	<p>The Proposal includes scope for the enhancement of existing shared paths as well as the construction of new active transport infrastructure, relative to the widening and upgrading of Hill Road and associated intersections as detailed in Chapter 3. The Proposal is not intended to deliver all active transport links identified in the Carter Street Master Plan and the larger area.</p> <p>The balance of active transport links would be delivered in stages as adjacent developments progress and will be overseen by the City of Parramatta Council.</p>
	<p>Pedestrian crossing time across the widened Hill Road from events would delay vehicle traffic at the M4 Motorway, Parramatta Road and local roads within Sydney Olympic Park.</p>	<p>The Proposal would provide capacity improvements not only for vehicles but also pedestrians with the new SUP along the eastern side between Carter Street and John Ian Wing Parade enhancing pedestrian and cyclist connectivity to the Sydney Olympic Park precinct. The SUP would travel from Parramatta Road to Carter Street on the western side of Hill Road where it would connect to an existing SUP continuing on to John Ian Wing Parade towards the Sydney Olympic Park.</p> <p>Event day impacts including pedestrian crossing time and potential of delayed vehicle traffic would be developed and managed with SOPA to best cater for these event days. Refer to Section 6.5 for further event day impacts.</p>
	<p>Design should include provision of two vehicular left in/left out entries into Carter Street Precinct (west) from Hill Road as the current Proposal restricts this access.</p>	<p>When the proposed Hill Road upgrade is completed, there will be three signalised intersections within short intervals along Hill Road (at Parramatta Road, the M4 eastbound off ramp and at John Ian Wing Parade – about 530m in distance). Additional signals in this section of road would likely create safety and traffic congestion issues.</p> <p>Transport for NSW is confident that the upgrade, as proposed, will create improved connectivity to the Carter Street and Sydney Olympic Park precincts, as well as improve journey reliability for through traffic to the Wentworth Point</p>

Stakeholder	Issue raised	Response / where addressed in REF
		<p>peninsula and Newington. This includes the aforementioned intersection upgrades, the widening of Hill Road, the eastern extension on John Ian Wing Parade, as well as the realignment of the left turn from Parramatta Road onto Birnie Avenue, Lidcombe, which will improve heavy vehicle access to the eastern side of the Carter Street Precinct. Details of the Proposal are in Chapter 3.</p>
	<p>Inclusion of appropriate construction mitigation measures to impacts of the Parkland as well as stormwater runoff into Haslam's Creek drainage system.</p>	<p>Impacts have the potential to change overland flow regimes and obstruct drainage paths which may result in temporary localised flooding. Flooding also has the potential to increase the risk of erosion and sedimentation particularly in areas where vegetation clearing, or excavation have been undertaken or stockpiles are located. To minimise the potential for localised flooding during construction, it would be necessary to plan, implement and maintain measures aimed at intercepting any concentrated flow and diverting it toward the existing stormwater drainage system. Monitoring of weather and moveable plant and equipment on the construction site would also be required to manage flood risk throughout construction.</p> <p>Details of the Proposal's impacts are in Chapter 6 and a summary of mitigation measures are in Chapter 7.</p>
	<p>Request for Transport for NSW to continue engaging with SOPA on Hill Road upgrade to inform the updated Sydney Olympic Park Master Plan</p>	<p>Consultation with SOPA has occurred through the development of the Proposal with key communications on 2 February and 28 May 2021. Responses are noted in Section 5.5 of the REF.</p> <p>Ongoing and future consultation would occur with SOPA as described in Section 5.6.</p>

5.6 Ongoing or future consultation

At the conclusion of the public consultation period for this REF, Transport for NSW would acknowledge receipt of feedback from each respondent. The issues raised by the respondents would be considered by Transport for NSW before determining whether to proceed with the Proposal.

Should Transport for NSW determine to proceed with the Proposal, the Determination Report would be made available on the Transport for NSW website and would summarise the key impacts identified in this REF, demonstrate how Transport for NSW considered issues raised during the

public consultation period, and include a summary of mitigation measures proposed to minimise the impacts of the Proposal.

If the REF is determined, community engagement would be required for activities in the next phases of the Proposal. Future consultation for the Proposal may include:

- property acquisitions and adjustments
- construction commencement
- construction methods and timing
- completion and opening to traffic.

The engagement techniques would include:

- media release for start of construction, notifications, webpage updates, VMS
- traffic alerts, notifications, doorknocking, webpage updates and media release, webpage updates, traffic alerts and notifications.

Other consultation activities that would be carried out include the following:

- consultation with key stakeholders to help in managing impact during construction
- follow-up meetings to discuss access arrangements with directly affected landholders
- on-going meetings with the relevant Councils, utility providers, nearby landowners and community
- stakeholders, as required
- ongoing updates of the Proposal on the website as required.

6. Environmental assessment

This chapter of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the Proposal.

6.1 Biodiversity

A biodiversity assessment technical paper was prepared for the Proposal and the results are summarised in this section. Refer to Appendix D for the detailed biodiversity assessment technical paper.

6.1.1 Methodology

The biodiversity assessment was prepared by WSP (WSP, 2021a) and included a desktop review of available information and documents including NSW and Commonwealth records, data and literature to confirm the likely presence of threatened flora, fauna and endangered communities in the study area as shown in Figure 3-1. Previous field survey information from February 2017 and January 2019 was considered and referenced to validate desktop assessment.

Desktop assessment

The biodiversity desktop assessment reviewed relevant databases detailed in Table 6-1. Commonwealth records and other data and literature were reviewed to confirm the likely presence of threatened flora and fauna species and endangered communities in the study area.

Table 6-1: Threatened and protected species database searches

Database	Search date	Search area
PlantNET Spatial Search	16 March 2021	10km radius centred on the study area
BioNet Atlas species sighting search	16 March 2021	10km x 10km centred on the study area
EPBC Protected Matters Search Tool	16 March 2021	10km radius on the study area
NSW Department of Primary Industries (Fishing and Aquaculture) spatial data	16 March 2021	Cumberland and Parramatta LGAs

6.1.2 Existing environment

Much of the existing environment within the study area is developed and previously cleared of vegetation. The environment surrounding the existing road is primarily light industrial with small areas of native vegetation near the Hill Road and John Ian Wing Parade intersection.

Vegetation communities

The following NSW Plant Community Types (PCTs) and non-native vegetation type were recorded within or immediately adjacent to the study area.

- PCT 724 Broad-leaved ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion
- Miscellaneous ecosystem – Urban exotic / native landscape plantings.

PCT 724 was assessed as being in a Poor condition class based on broad vegetation condition class criteria. Non-native vegetation was not assigned a condition class.

Table 6-2 provides a summary of the vegetation within the study area along with a detailed description of each PCT and vegetation patches and is also shown in Figure 6-1.

Table 6-2: Plant Community Types and Threatened Ecological Communities recorded

Vegetation type	Condition	Vegetation formation	Vegetation class	NSW TEC listing	EPBC TEC listing	Area within the Proposal (Ha)
Native Plant Community Types						
PCT 724	Poor	Dry sclerophyll forests (shrub/grass sub-formation)	Cumberland dry sclerophyll forests	Forms part of Shale Gravel Transition Forest in the Sydney Basin Bioregion, listed as Endangered (BC Act) and Critically Endangered (EPBC Act).	N/A	0.03
Miscellaneous ecosystems¹						
Highly disturbed areas with no or limited native vegetation	N/A	N/A	N/A	Not listed	Not listed	0.64

¹Miscellaneous ecosystems are commensurate with previously disturbed land as classified under the ISCA.

The one plant community type, PCT 724, is consistent with the BC Act listed threatened ecological community *Shale Gravel Transition Forest in the Sydney Basin Bioregion* (Shale Gravel Transition Forest) and was recorded on the edges of the Proposal. This vegetation occurs as three fragmented patches that have been disturbed and exhibit exotic species; particularly in the ground stratum. Each occurrence of this community is within a mature age class and is considered highly likely to respond to assisted natural regeneration, as the natural soil and associated seedbank is still at least partially intact.

The listed threatened ecological communities with matters of national environmental significance (MNES) under the EPB Act is PCT 724 as it can potentially form part of the TEC Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest, which is listed as Critically Endangered under the EPBC Act. Based on the small patch (0.3 Ha) size of PCT 724 within the study area, it is considered that this vegetation does not meet the thresholds for the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest listed under the EPBC Act.

In addition, wetlands of international importance (Ramsar) are also considered in this assessment. There are two nationally important wetlands located downstream from the Proposal (about 2 kilometres); Newington Wetland and Bicentennial Park. These wetlands are listed as nationally important wetlands and provide habitat for migratory birds. It is unlikely that the study area would interfere with existing conditions of these wetlands.



Figure 6-1: Plant communities and habitat features

Threatened flora

There are 44 threatened flora species listed under the NSW BC Act (further detailed in Appendix D) recorded or predicated to occur within or near the study area. During previous surveys undertaken in 2017 and 2019, no threatened flora species were recorded.

Threatened fauna

There are 62 threatened fauna species listed under the NSW BC Act and/ or FM Act (further detailed in Appendix D) recorded or predicated to occur within the study area. Based on the presence of potentially suitable habitat and known occurrences in associated habitats in the wider locality from the previous survey, eight threatened fauna species are considered to have a moderate or greater likelihood of occurrence based on the habitat in the Proposal:

- Little Lorikeet (*Glossopsitta pusilla*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Eastern Freetail Bat (*Micronomus norfolkensis*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
- Little Bent-wing Bat (*Miniopterus australis*)
- Southern Myotis (*Myotis Macropus*)
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)

Fauna habitat

The study area contains poor quality habitat due to predominantly disturbed land providing foraging and roosting habitat for highly mobile species such as birds and bats due to its fragmented nature. Habitat within the study area is highly isolated with limited connectivity to surrounding native vegetation communities. For this reason, more habitat is suited to species that are more mobile and capable of moving across a highly fragmented landscape (i.e. birds and bats). Much of the available native vegetation and habitat in the study area is disturbed with the majority of ground covers being exotic species.

The previous survey undertaken did not record important roosting habitat sufficient to accommodate colonies of hollow-dependant bats. Artificial habitat for Large Bentwing Bat (*Miniopterus orianae oceanensis*), Southern Myotis (*Myotis macropus*) or Little Bentwing Bat (*Miniopterus australis*), may exist in the local area in the form of bridges and culverts. Blossoming eucalypts and fruiting trees also provide seasonal foraging resources for Little Lorikeet (*Glossopsitta pusilla*) and Grey-headed flying-fox (*Pteropus poliocephalus*).

Although no breeding habitat (i.e. permanent to semi-permanent water bodies) or foraging habitat (i.e. grasses, tussocks and emergent sedges and reeds bordering water bodies) was identified in the study area, the vegetation adjacent to Hill Road and Haslams Creek has the potential to provide dispersal habitat for Green and Golden Bell Frog due to its connectivity to known habitat along the riparian corridor of Haslams Creek.

There is potential during optimal conditions (i.e. during warmer months after heavy rain or storms) that individuals may on rare occasions disperse into the study area on native vegetation adjacent to Hill Road and Haslams Creek. The habitat within the study area is only likely to be occasionally utilised during optimal conditions when the species would disperse from known habitat. The loss of this dispersal habitat is not considered to meet impact thresholds and further consideration of the Green and Golden Bell Frog is not warranted.

An MNES search identified 35 threatened flora species occurring or considered likely to occur in the study area. Of these, one threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*), was assessed as having a moderate likelihood of occurring in the study area based on available habitat, mobility and known occurrences in the wider locality.

6.1.3 Potential impacts

Construction

Direct impacts

The Proposal would require the removal of about 0.67 hectares of native vegetation and threatened ecological communities as detailed in Table 6-3. This vegetation removal also accounts for removal of threatened fauna habitat.

Table 6-3: Direct impacts from the Proposal

Vegetation type	Potential impact (Ha)
PCT 724 Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin	0.03
Miscellaneous ecosystem: urban exotic / native landscape plantings	0.64

No threatened flora would be impacted from the Proposal.

Indirect impacts

The Proposal is unlikely to impact wildlife connectivity and habitat fragmentation as the removal of habitat is minor. Functional connectivity for many species would remain in the study area as existing conditions.

As the Proposal is located in an existing urban development and adjacent roads, there is unlikely to be any further impacts from edge effects from the Proposal. The vegetation patches are suffering from weed invasion and the habitats that would be impacted by the Proposal are edge habitats without any undisturbed core.

The Proposal has the potential to further disperse weeds into nearby areas of native vegetation. The greatest potential for weed dispersal and establishment associated with the Proposal would include earthworks, movement of soil and attachment of seed (and other propagules) to vehicles and machinery where these are utilised within or adjacent to retained vegetation. The clearing of native vegetation for the Proposal, including earthworks would increase the potential for weed invasion into adjacent patches of native vegetation. Management measures would be required to minimise the risk of introduction and spread of weeds as described in Section 6.1.4.

Operation

The operation of the Proposal is not anticipated to result in any further impacts to biodiversity.

Conclusion on significance of impacts

The Proposal is not likely to significantly impact threatened species or ecological communities or their habitats, within the meaning of the BC Act or *Fisheries Management Act 1994* and therefore a Species Impact Statement or Biodiversity Development Assessment Report is not required.

The Proposal is not likely to significantly impact threatened species, ecological communities or migratory species, within the meaning of the EPBC Act.

6.1.4 Safeguards and management measures

Table 6-4: Biodiversity safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity	<p>A Flora and Fauna Management Plan would be prepared in accordance with Transport for NSW's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects</i> (RMS, 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> (RMS, 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	Section 4.8 of QA G36 <i>Environment Protection</i>
Vegetation	Native vegetation removal would be minimised through the detailed design process	Proposal design engineer	Detailed design	Additional safeguard
Vegetation	Vegetation removal would be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011a).	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Vegetation and habitat	<p>A detailed landscape plan would be prepared during detailed design and include detailed species and planting guides as well as areas disturbed for construction. Where areas of habitat are to be re-established, this would occur consistent with <i>Guide 3: Re-establishment of Native Vegetation of the Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011b).</p> <p>A detailed landscape plan would aim to:</p> <ul style="list-style-type: none"> • enhance habitat • reconstruct habitat in strategic areas to link areas of conservation value increasing buffer zones. 	Contractor	Detailed design	Additional safeguard
Vegetation and habitat	<p>Exclusion zones would be set up at the limit of clearing in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011c). Exclusion zones would be established to avoid damage to native vegetation and fauna habitats identified for retention and prevent the distribution of weeds. The location of exclusion fencing to be installed would be identified by project environmental management plans and the function and importance of the exclusion zones would be communicated to construction personnel.</p>	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Vegetation and habitat	Weed species would be managed in accordance with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011d).	Contractor	Construction	Additional safeguard
Vegetation and habitat	A weed management plan consistent with the <i>Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011e) would be developed as part of the construction environmental management plan. The weed management plan would include descriptions and mapping of major weed infestations and appropriate management actions to be undertaken in relation to each infestation.	Contractor	Construction	Additional safeguard
Vegetation and habitat	Pest species would be managed within the study area.	Contractor	Construction	Additional safeguard
Vegetation and habitat	Pathogens would be managed in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011f).	Contractor	Construction	Additional safeguard
Vegetation and habitat	Measures to prevent the spread of pathogens would be detailed in the construction environmental management plan. Measures would be consistent with <i>Roads and Maritime Biodiversity Guidelines – Guide 7: Pathogen Management</i> (RTA, 2011g). This would include measures to minimise the spread of Chytrid fungus and would be implemented during construction.	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Habitat	Habitat removal would be minimised through detailed design.	Contractor	Detailed design	Additional safeguard
Habitat	Pre-clearing surveys would be undertaken in accordance with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011c). Pre-clearing surveys would be undertaken by an experienced ecologist to identify any nesting/roosting animals present in the study area. This would include inspections of affected existing structures for microbats that may be present in cracks, fissures, scuppers, lifting holes or similar. An experienced ecologist would also be present during any clearing of native vegetation.	Contractor	Pre-construction	Additional safeguard
Habitat	Pre-clearing surveys, if required, would be undertaken in accordance with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011c).	Contractor	Construction	Additional safeguard
Habitat	The unexpected species find procedure would be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011e) if threatened flora species, not assessed in the biodiversity assessment, are identified in the study area.	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Habitat	The unexpected species find procedure would be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011a) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the study area.	Contractor	Construction	Additional safeguard
Habitat	Habitat removal would be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011a).	Contractor	Construction	Additional safeguard
Habitat	Habitat would be replaced or re-instated in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011h), where possible.	Contractor	Construction	Additional safeguard
Fauna	Fauna would be managed in accordance with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011i).	Contractor	Construction	Additional safeguard

6.1.5 Biodiversity offsets

The Proposal is being assessed under a REF and in reference with *Section 4.2: Table 1 – RMS Guidelines for Biodiversity Offsets* (RMS, 2016) would not meet the threshold criteria required to offset impacts to native vegetation or threatened species habitat recorded within the study area. Refer to Appendix D for further details.

6.2 Hydrology and flooding

This section summarises the results of the Flood Impact Assessment (FIA) (2021) undertaken by Royal HaskoningDHV and provided in Appendix E.

6.2.1 Methodology

The methodology used to assess the potential hydrology and flooding impacts of the Proposal included:

- review and update of existing hydraulic modelling used for the 2019 and 2021 FIA
- review of the 2016 Haslams Creek Flood Study update
- completion of flood modelling for the 20%, 10%, 5%, 1%, 0.5% and 0.2% Annual Exceedance Probability (AEP) flood events, as well as the Probable Maximum Flood (PMF)
- assessment of the potential impact of the Proposal on flood behaviour for selected AEP design flood events, including proposed points of discharge
- assessment of the impact of partial pipe blockage
- assessment of climate change on flood behaviour for selected design flood events.

6.2.2 Existing environment

The Proposal is located within the Haslams Creek and Haslams Creek Tributary (Arthur Branch Channel) catchment areas. The catchment immediately upstream and adjacent to the Proposal is characterised by commercial allotments, urban roads, major highways and small areas of hard surfaces.

The local topography is relatively flat with drainage slopes generally less than 5%. Drainage paths are mostly piped or constructed concrete open channels.

Areas of the Proposal associated with flood risk have been identified at three key locations.

- Hill Road and John Ian Wing Parade intersection
- Hill Road and M4 Motorway underpass, and
- Parramatta Road.

Nearby, Haslams Creek is mapped as a flood area, with flood depths for a 20% AEP flood event of between 2.6 to 3.3 metres. During rainfall events greater than 1% AEP tailwater from Haslams creek would impact the Hill Road and John Ian Wing Parade intersection. Refer to Figure 6-2 for the existing 20% AEP. Additional flood maps are provided in the Appendix A of the FIA.

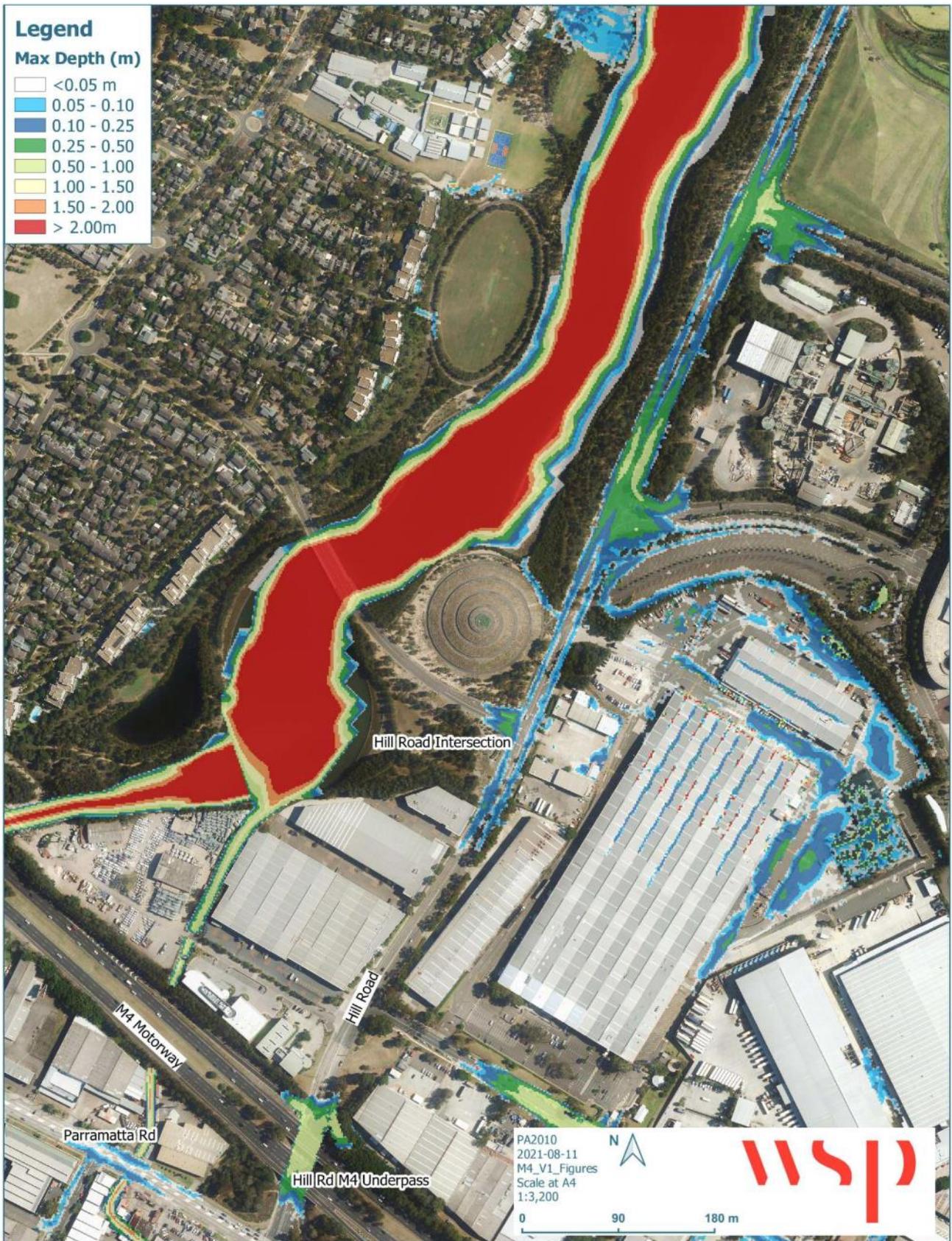


Figure 6-2: Existing 20% AEP flood event (maximum flood depths)

6.2.3 Potential impacts

Construction

During construction of the Proposal, flood prone land is expected to be impacted by a 20% AEP flood event at the Hill Road and John Ian Wing Parade intersection (adjacent to the location of the proposed site compound), the Hill Road and M4 Motorway underpass and Parramatta Road.

The Proposal is expected to modify flood risk areas due to proposed increases in road elevation. Depending on the stage of construction, changes in the road elevation may temporarily increase the flood risk of the proposed site compound (refer to Figure 6-3), (further discussed in *Operational Impacts*).

During construction, flood prone areas have the potential to be impacted by flood events greater than a 20% AEP event, potentially changing overland flow regimes and causing obstruction of drainage paths. This may result in temporary localised flooding and changes surface flows.

Flooding also has the potential to increase risk of erosion and sedimentation particularly in areas where vegetation clearing or excavation have been undertaken and / or stockpiles are located.

To minimise the potential impacts of flooding to and from the Proposal, mitigation and management measures outlined in Table 6-5 would be implemented.

To minimise the potential for localised flooding (and erosion) during construction, it would be necessary to plan, implement and maintain measures aimed at intercepting any concentrated flow and diverting it toward the existing stormwater drainage system. Monitoring of weather and the consideration of the location of moveable plant and equipment on the construction site would be required to manage flood risk throughout construction.

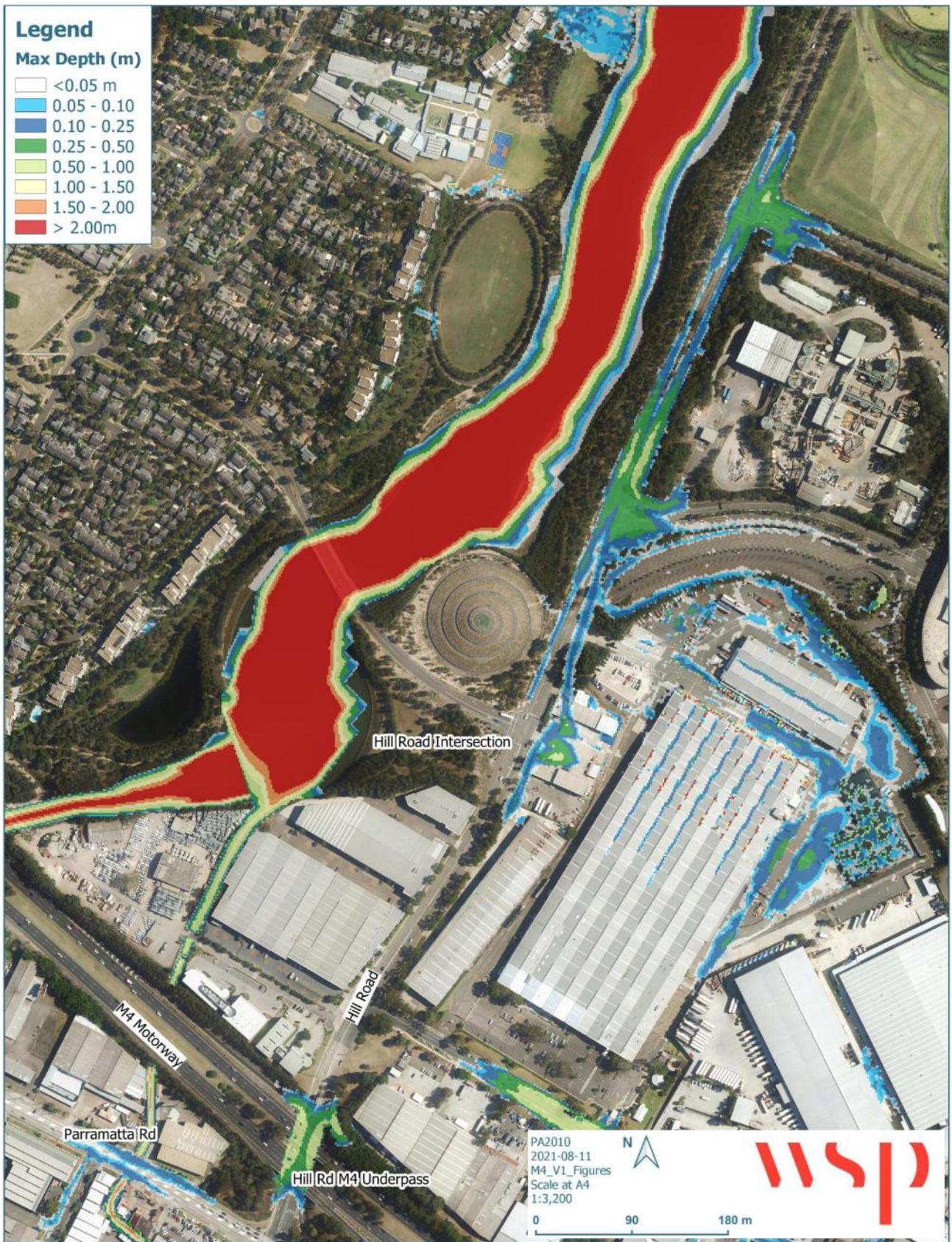


Figure 6-3: 20% AEP flood event (Proposed maximum flood depths)

Operation

Operation of the Proposal would result in a minor increase in the impervious area within the Haslams Creek Catchment, as well as a minor increase in peak flow at the Haslams Creek Tributary (Arthur Branch channel) due to the increased hydraulic connectivity between Hill Road and Parramatta Road. The increase is not expected to significantly modify the catchment as changes to total flow volume are less than 1% across all AEP design events.

Although the Proposal is unable to completely reduce peak flood levels in the 1% AEP, the flood impacts would remain generally confirmed to the three locations as described in Section 6.2.2. It should be noted however, that the proposed change in road elevation and the upgraded pit and pipe network would result in a general reduction in flood depths and lower flood levels in these areas as well as improved drainage for smaller flood events.

Hill Road and John Ian Wing Parade intersection

The changes in road elevation on Hill Road and geometry change to the eastern side of Hill Road between Carter Street, and the Old Hill Link Road would result in a reduction of flood depth along the main part of Hill Road. The middle section would be flood free during most flood events, with flood waters ponding further east and west and west along Hill Road, as flood waters are forced off the main part of the road to the side. This change is partially mitigated by a more extensive pit and pipe network which allows more water to enter the drainage system. The difference in flood levels is generally small (less than 6 centimetres in the 1% AEP).

Hill Road and M4 Motorway underpass

The Hill Road underpass currently experiences peak flood depths of up to 1.4 metres in the 1% AEP 90-minute flood event. The proposed drainage upgrades in this area reduce the peak flood levels up 23 centimetres in the 1% AEP. Changes to ground elevations result in some small newly flooded areas and some areas that are no longer flooded.

Parramatta Road

Parramatta Road, west of the underpass experiences peak flood depths of up to 60 centimetres for both the existing and proposed scenarios under the 1% AEP. Geometry changes at this location are minor, however changes in surface elevation would result in increased flood depths up to 40 centimetres occurring near the property at 99 Parramatta Road.

Figure 6-4 shows flooding depth difference under the 1% AEP.

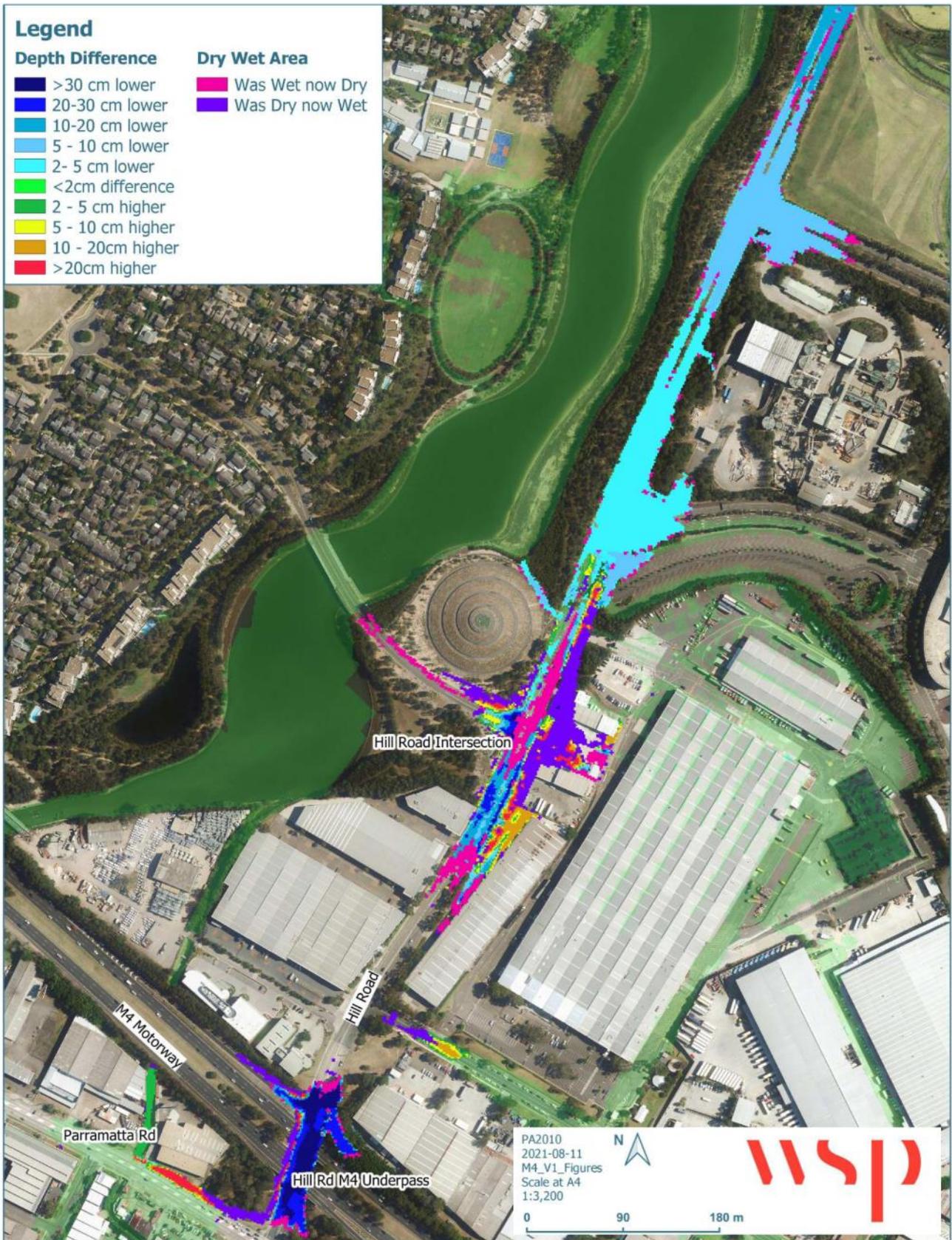


Figure 6-4: 1% AEP flood event (Depth difference)

6.2.4 Safeguards and management measures

Table 6-5: Hydrology and flooding safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Flooding	Appropriate sediment and erosion controls (as detailed in the construction environmental management plan (CEMP)).	Contractor	Construction	Additional safeguard
Flooding	To reduce any potential flood impacts during construction, any stockpiles should be outside the 1% AEP flood extent. Where this is not possible, stockpiles should not be placed in floodways and suitable erosion control is used.	Contractor	Construction	Additional safeguard
Flooding	If the site compound cannot be situated outside the 1% AEP, any site building should be above flood planning level (1% AEP = 0.5m freeboard) and a site management plan that can reduce flood losses to personnel and equipment including consideration of moveable plant and equipment is developed and followed.	Contractor	Construction	Additional safeguard
Flooding	Any works on existing drainage networks should be scheduled with consideration of rain / flash flood forecasts provided by the Bureau of Meteorology.	Contractor	Construction	Additional safeguard

6.3 Surface water and groundwater

6.3.1 Methodology

The methodology for assessing potential impacts to surface and groundwater included the following:

- Review of publicly available information and relevant information including:
 - Appendix G (Soil, Water and Waste Technical Study) of the WestConnex M4 Widening Project Environmental Impact Statement (EIS), (SMEC, 2014), which provided a reference for assessment criteria and mitigation measures for a recent similar project in the area
 - engineering design drawings for the Proposal
 - utility survey data for Hill Road
 - aerial photography and two metre contour data (LiDAR) across the study area
 - the Parramatta River Estuary Coastal Zone Management Plan (Cardno, 2012)

- data provided by Sydney Olympic Park Authority (SOPA) including:
 - stormwater drainage design information
 - routine water quality monitoring results for Haslam’s Creek undertaken between 2004 and 2006.
 - Bureau of Meteorology (BOM) rainfall data.
- A site visit to visually examine the condition of existing drainage infrastructure and watercourses in the study area.
- An assessment of the Proposal’s potential construction phase impacts on soils, sediments, and receiving watercourses.
- An assessment of the Proposals construction methodology and potential impacts to surface water quality.
- An assessment of the Proposal’s potential operational phase impacts on surface water quality. As part of this assessment a water quality model was developed using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software to quantify pollutant loads discharged to receiving watercourses from the road drainage outlets associated with the Proposal.
- Identification of recommended management and mitigation measures to address the potential impacts on surface water quality during construction and operation.

The assessment focuses on three key pollutants: Total Suspended Solids (TSS), Total Nitrogen (TN) and Total Phosphorus (TP). The assessment provides a treatment strategy to reduce these pollutants to meet either the Water Quality Objectives (WQO) or to minimise changes to the water regime where the baseline water quality in the receiving creek does not meet the WQOs.

Study area

The water quality assessment study area includes the local drainage catchment of Haslams Creek and its associated tributary. Haslams Creek is a tributary of the Parramatta River and drains into Homebush Bay. Refer to Figure 6-5 for the assessment study area.

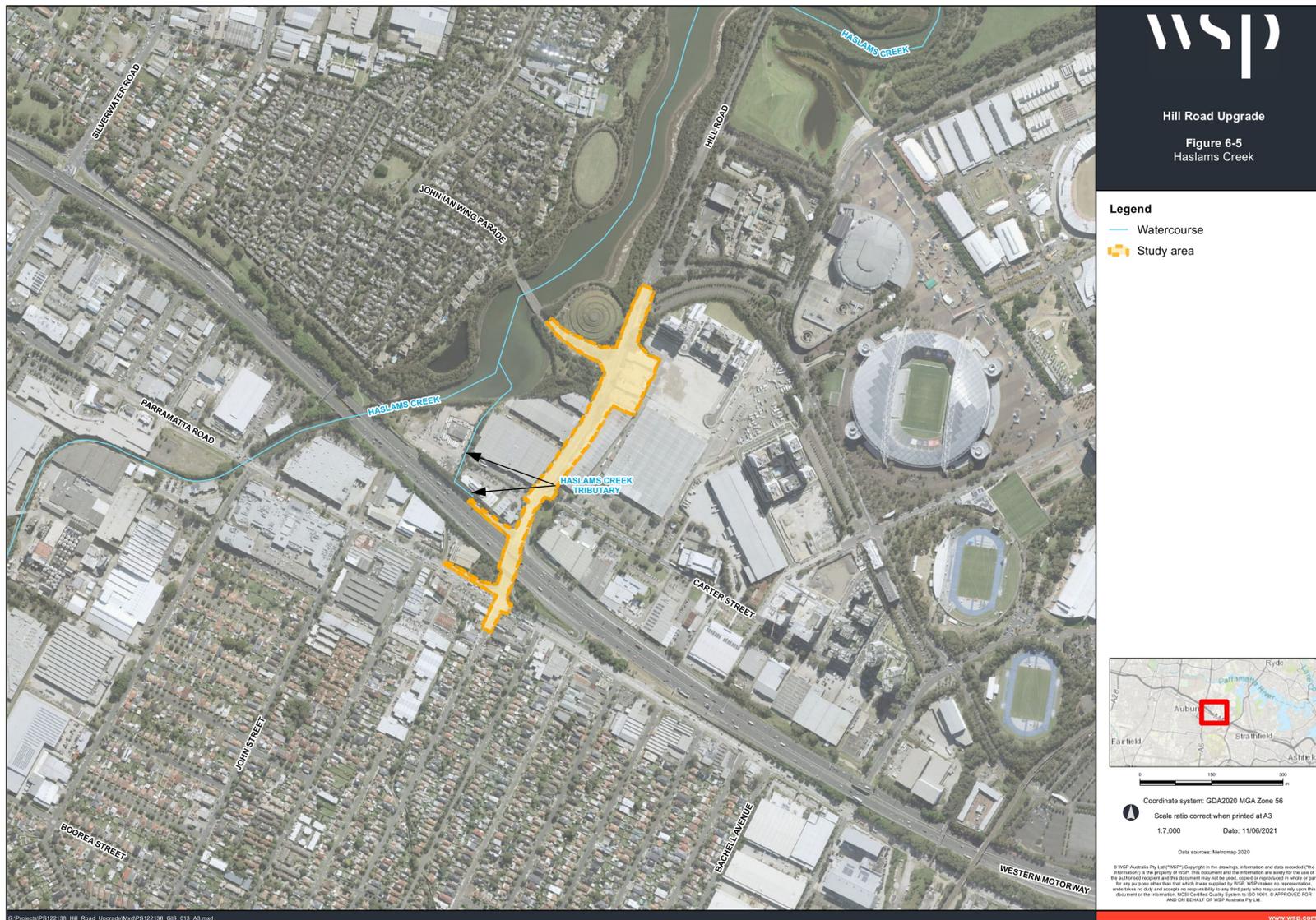


Figure 6-5: Surface water assessment study area

6.3.2 Existing environment

Surface water

The Proposal is located within the Haslams Creek drainage catchment. Haslams Creek flows downstream to the join the estuarine portion of the Parramatta River. The Parramatta River is tidal to the Charles Street Weir at Parramatta. This section describes the character of Haslams Creek and its tributary along with how stormwater currently drains from Hill Road.

Haslams Creek, and its tributary, flow into the Parramatta River at Homebush Bay near Wentworth Point. Haslams Creek's catchment is about 17 km². It is heavily urbanised and much of the creek upstream of Parramatta Road is a lined concrete channel. The creek is unlined downstream of Parramatta Road, where it crosses the existing M4 Motorway. Haslams Creek and its associated tributary are 1st order streams immediately upstream of the existing M4 Motorway, and 2nd order streams downstream of the M4 Motorway.

Water quality

The Parramatta River Estuary Coastal Zone Management Plan (Cardno, 2012) notes that key water quality parameters of concern for management in Parramatta River include: dissolved oxygen, pH, turbidity, nutrients (nitrogen and phosphorus), algal concentrations and pathogens (faecal coliforms and enterococci).

Water quality monitoring undertaken by SOPA between 2004 and 2006 on Haslam's Creek indicates that water quality in Haslam's Creek is generally poor, frequently exceeding the Australian and New Zealand Environment Conservation Council (ANZECC) water quality guidelines with elevated nutrient levels in TN and TP.

Sampled water quality in Haslam Creek were taken upstream and downstream of the M4 Motorway crossing, located upstream of the discharge point of any stormwater runoff from the Proposal (SMEC, 2014). The existing water quality data indicates the quality was similar to the conditions recorded from the 2004 to 2006 monitoring.

The baseline Haslams Creek water quality exceeds the benchmark WQOs for TN and TP. As there is no proposed benchmark WQO for TSS, the Proposal specific WQO for this parameter is also set at the baseline water quality concentration. The baseline water quality conditions for the key pollutants set for this Proposal is shown in Table 6-6.

Table 6-6: Baseline water quality objectives

Pollutant	Baseline water quality concentrations in Haslams Creek (average values)
TSS	78.9 mg/L
TN	2.0 mg/L
TP	0.2 mg/L

Groundwater

Depth to groundwater within the Proposal study area is unknown. A search of the Australian Groundwater Explorer database on 30 April 2021 indicates that there are no registered groundwater bores within 500 metres of the Proposal. The closest registered ground bore is around 850 metres to the north-west of the Proposal.

6.3.3 Potential impacts

Construction

The proposed excavation and construction work would involve vegetation removal and modification of existing built features (e.g. paved surface). Potential impacts on water quality include:

- degraded water quality from chemicals or hazardous material entering Haslams Creek from accidental spills and inadequate management of sediment laden runoff
- fuel, chemicals, oils, grease and petroleum spills from construction machinery directly polluting soils and watercourses within the catchment
- increased erosion and sedimentation smothering aquatic life and affecting aquatic ecosystems
- reduced hydraulic capacity due to deposition of material in the channels of receiving watercourses
- contamination of receiving watercourses due to runoff from disturbed areas of contaminated land.

There is not expected to be any groundwater impacts during construction as there are no deep excavations that may encounter the groundwater table.

Implementation of safeguards in Table 6-7 would minimise risk and potential impacts on water quality.

Operation

Surface water

Alterations to the surface water flows would likely be within the capacity of the stormwater network and as such, impacts would be minor. Additionally, given the Proposal would not result in an increase of impervious surfaces, this would also ensure that surface water flows are not impacted during operation.

Water quality

Operational water quality impacts are largely associated with pollutants discharged to receiving watercourses in the road runoff. Pollutant deposits built up on road surfaces and pavement areas during dry weather are likely to be washed off and transported to watercourses during wet conditions and storm events. These pollutant deposits include:

- sediments from pavement wear and atmospheric deposition
- heavy metals such as lead, zinc, copper, cadmium, chromium and nickel attached to particles washed off the road pavement
- oil, grease and other hydrocarbon products
- rubber from tyre wearing
- brake pad dust, which could potentially include asbestos from older brake pads
- nutrients such as TN and TP.

The Proposal may reduce the risk of road traffic spills (e.g. accidental fuel, chemical spills) from traffic accidents as the Proposal has been designed to improve the safety of Hill Road.

During operation of the Proposal, road drainage would discharge into the Haslams Creek tributary and Haslams Creek via pipe networks. The Proposal is not expected to significantly increase the impervious area in the catchments.

The amount of pollutant concentration discharged to Haslams Creek is dependent on whether a stormwater treatment system would be installed to reduce key pollutants loading on Haslams Creek from the Proposal.

As pollutant concentrations are above the baseline, the Proposal would implement Gross Pollutant Traps (GPT), where possible. The installation of GPTs or a similar stormwater treatment system is likely to provide a reduction in pollutant loads and provide the opportunity to capture a certain volume of accidental oil/fuel spill.

The GPT however would only slightly reduce the pollutant concentrations and would remain above the baseline. Potential impacts are minimised and the Proposal is expected to have a minor impact due to the reductions in pollutant loads. During detailed design, the contractor would investigate the potential use of practicable measures to optimise pollution mitigation. This would include GPTs or similar proprietary products.

6.3.4 Safeguards and management measures

Table 6-7: Surface water and groundwater safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Soil and water	A Soil and Water Management Plan (SWMP) would be prepared and implemented as part of the CEMP. The SWMP would identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks would be addressed during construction.	Contractor	Detailed design / pre-construction	Section 2.1 of QA G38 <i>Soil and Water Management</i>
Soil and water	The SWMP would a site-specific Erosion and Sediment Control Plan/s 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	Section 2.2 of QA G38 <i>Soil and Water Management</i>
Soil and water	The SWMP would be prepared for the project in accordance with: Managing Urban Stormwater–Soils and Construction, Volume 1 Managing Urban Stormwater, 4 th edition ('the Blue Book'). Managing Urban Stormwater–Soils and Construction, Volume 2D Main Road Construction.	Contractor	Detailed design / Pre-construction	Additional safeguard
Erosion and sedimentation (Construction)	Measures would be implemented during construction to minimise the risk of erosion, sedimentation and pollution. These measures may include: <ul style="list-style-type: none"> avoid disturbance where practicable, otherwise minimise the area of 	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>disturbance, particularly on and adjacent to river banks.</p> <ul style="list-style-type: none"> • designate of 'no-go' zones for construction plant and equipment • install upstream diversion channels to direct clean runoff from upstream catchments around or through disturbed areas (maintaining separation from runoff containing sediment) • shape disturbed land to minimise slope lengths and gradients and improve drainage • install/line catch drains to carry any sediment laden runoff to appropriate sediment control measures • minimise stockpiling of material • remove cleared or excavated materials as soon as practicable after excavation and appropriately dispose of or stockpile off-site • locate stockpiles away from drainage lines and creek channels • seed disturbed areas for temporary soil stabilisation • employ appropriate measures to prevent/minimise wind-blown dust from leaving the site (e.g. watering) • establish designated areas for plant and construction material storage within site compounds and other locations within the Proposal • store all chemicals and fuels associated with construction in secure roofed and bunded areas • retain erosion and sediment controls until disturbed areas are stabilised. 			

Impact	Environmental safeguards	Responsibility	Timing	Reference
Erosion and sedimentation (Operation)	Measures would be implemented during operation to minimise the risk of erosion and sedimentation. These measures may include monitoring and remediation during schedule road maintenance of planting where vegetation cover has not established or has only partially established.	Transport for NSW	Operation	Additional safeguard
Water quality	Detailed design would consider practicable measures to optimise pollution mitigation, and accidental oil/fuel spill containment. This would include GPTs or similar proprietary products.	Transport for NSW	Detailed design	Additional safeguard
Water quality	Oil/fuel spill mitigation measures would be incorporated into the longitudinal drainage system (e.g. sandbagging of last pit in the drainage network following a spill event) as the longitudinal drainage system has been designed to be separate to any transverse drainage systems, in accordance with good practice and Transport for NSW water management policy.	Transport for NSW	Detailed design	Additional safeguard
Water quality	Suitable protection measures would be provided at pipe outlets and at locations where there is a risk of creek bank instability due to discharges from the pavement drainage system.	Transport for NSW	Detailed design	Additional safeguard

6.4 Contamination, geology and soils

A Phase 1 Contamination Assessment (Phase 1) was undertaken to assess the potential impacts of the Proposal to contaminated land (WSP 2021b). The findings of the Phase 1 assessment are discussed in the following section. A Phase 2 Detailed site investigation (DSI) was also undertaken as part of the geotechnical survey work undertaken from 14 to 17 November 2016 and on 23 February 2017 (WSP, 2017).

The full Phase 1 and DSI are provided in Appendix F of this REF.

6.4.1 Methodology

The Phase 1 assessment included a review of the following information:

- aerial photographs of the local area held by NSW Land and Property Information taken in 1943, 1965, 1982, 1994, 2005, 2014 and 2016 to confirm the area's historic land uses
- registered borehole data within 500 metres of the Proposal to assess groundwater use locally
- contaminated land records including notice and licence data held by the EPA to identify the location, extent and current status of declared contaminated land and other potential contaminating activities locally
- information documenting historical road traffic accidents, spills, licenced and unlicensed waste disposal, or other contaminating/polluting activities locally
- physical site setting information on topography, geology and hydrogeology and potentially sensitive receptors (known as receivers and values elsewhere in the modification report) close to the Proposal
- City of Parramatta Council and Cumberland Council records to identify current land use zoning locally, and current planning overlays that are of relevance to contaminated sites
- previous environmental investigations from a 2014 Phase 1 assessment from the M4 Widening EIS.

The methodology for the Phase 2 DSI included:

- soil sampling from six geotechnical boreholes from the M4 Widening EIS (WSP, 2017)
- screening for field pH (pHF) and oxidised field pH (pHFOX) to indicate potential for acid sulfate soil (ASS) and to support laboratory testing
- groundwater sampling from well PBBH2
- analysing soil and groundwater samples for contaminants of concern
- additional targeted soil sampling in seven locations in February 2017 to provide an indicative waste classification
- previous environmental investigations from a 2014 Phase 2 DSI.

The study area for this assessment is defined as described in Chapter 3 on Figure 3-1.

6.4.2 Existing environment

Historical and site context

The earliest aerial photography available of the study area is from 1943 in which the Proposal is a dirt /unsealed road and mainly surrounded by vegetated land with a few small scale buildings scattered around the area.

According to aerial photography taken in 1965, Hill Road is shown as widened and slightly deviated toward Parramatta Road. There also is an increase of commercial and industrial development. Coming into 1982, the study area shows the addition of the M4 Motorway which crosses over Hill Road.

During this time period, Hill Road is also extended farther north beyond Old Link Road and there is an increase of warehouse development built to the east of Hill Road on both sides of Carter Street.

From the early 90's through mid-2000's, Hill Road remains mostly unchanged. The surrounding area includes additional commercial and industrial businesses, development of the Sydney Olympic Park, residential properties and widening of Haslams Creek.

The Sydney Olympic Park site and the Homebush Bay area have had a known contamination history, which had only been partially remediated and/or encapsulated before Olympic Games started in 2000. The Homebush Bay area hosted a number of industrial and manufacturing activities including the State Abattoirs, the State Brickworks, Navy's armament depot, chemical manufacturing, and fuel processing. Although extensive landfilling and reclamation using uncontrolled waste took place across the Sydney Olympic Park early 1980s, there is a possibility of historical fill material beneath the study area.

To date, the land use near and within the Proposal study area is similar to its historical context. The area includes a number of medium to large sized operational commercial businesses. The types of business are primarily industrial like retail warehousing, mechanical equipment, high-tech speciality chemicals and automotive businesses.

Topography

Hill Road's elevation increases from about six metres above Australian height datum (AHD) near the M4 Motorway to about 10 metres above AHD at the northern end of the Proposal study area. The natural topography of the surrounding area is also relatively flat with a general slope to the north and north-west towards Haslams Creek and its supporting tributary.

The landform has been modified within the Sydney Olympic Park and around the Haslams Creek Flats following the area's remediation prior to the 2000 Sydney Olympics.

Geology

Based on the 1:100,000 Sydney Geological Series Sheet (9130), the local area is located on Quaternary alluvial deposits of silty to peaty quartz sand, silt and clay associated with an historical drainage line leading to Homebush Bay, with the portion south of the M4 Motorway located on Triassic Ashfield Shale formed of black-to-dark-grey shale and laminate. The alluvium and shale are locally underlain by Hawkesbury Sandstone described as medium-to-coarse grained quartz sandstone with very minor shale and laminate lenses. Table 6-8 summaries the geology characteristics based on the previous geotechnical investigations.

Table 6-8: Geology characteristics

Group/unit	Characteristics	Location and depth
Made ground	Sandy/silty clay, gravel and fill	0 metre to 0.5 metre: Hill Road 0 metre to 1.75 metres: M4 Motorway
Alluvial deposits	Sands and (clayey) silts	0.7 metres to 2.1 metres: Haslams Creek corridor and an historical drainage line
Residual (leftover) clay	Stiff/hard (sandy/silty) clay	2 metres to 4.5 metres: whole area
Shales	Black to dark grey weathered shale and laminate	Up to 5 metres: whole area
Sandstone	Medium to coarse sandstone that includes small amounts of shale and laminate lenses	Below 5 metres: across the entire study area

Soil landscapes

Based on the 1:100,000 Sydney Soil Landscape Series Sheet (9130), the local area is underlain by both the Blacktown and Birrong soil landscapes.

Table 6-9 summaries the soil characteristics based on the previous geotechnical investigations.

Table 6-9: Soil characteristics

Group/unit	Characteristics	Location and depth
Birrong soils	Yellow iron-rich saline soils associated with Haslams Creek Localised flooding, erosive and seasonally waterlogged	Up to 2.5 metres: Hill Road
Blacktown soils	Residual (leftover) soils Poor draining, moderately-to-highly erosive	Up to 1 metre: M4 Motorway and Parramatta Road

As part of the previous geotechnical investigations, there were soil samples collected and analysed from each borehole. The samples were selected based on a combination of sample location and depth (to provide site coverage) and field observations. Refer to Appendix F for detailed analytical results and laboratory reports.

The following is a summary of the soil analysis of the collected samples:

- hydrocarbons were below laboratory limit of reporting
- no presence of asbestos were detected
- heavy metals were detected in most samples analysed for arsenic, lead, chromium, copper, nickel and zinc
- presence of dioxin and furan compounds.

Acid sulfate soils

The Acid sulfate soils (ASS) risk map prepared for the area by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) indicate that most of the local area is located on disturbed terrain.

The Auburn LEP ASS map indicated that most of Hill Road is located within a high risk Class 2 ASS area. The area around Birnie Avenue is located in a Class 5 ASS area, which is defined as an area within 500 metres of Class 1 to 4 areas. The State Environmental Planning Policy (SEPP) (Major Development) 2005 ASS map indicates that the northern end of the Proposal, near John Ian Wing Parade, is located in disturbed terrain which is unlikely to be ASS. Appendix F includes copies of the LEP (2013), SEPP (2005) and CSIRO (2013) ASS maps.

Based on the geotechnical investigations, field soil pH measurements confirmed ASS were generally slightly acidic and above a pH of 5.0.

NSW EPA database search

A search of the NSW EPA Contaminated Land records on 8 March 2021 showed there are three sites within a one kilometre radius of the study area, two of which that have been included on the NSW EPA contaminated sites register as shown in Table 6-10.

Table 6-10: NSW EPA database search

Site	Address	Activity	EPA site management class	Location from study area
Metro Lidcombe (former Liberty)	134 John Street, Lidcombe	Service station	Contamination currently regulated under POEO Act	750 metres south
Haslams Creek South, Area 3¹	At Kronos Hill, Kevin Coombes Avenue, Sydney Olympic Park	Landfill	Contamination formerly regulated under the CLM Act	1,000 metres north-east
Kronos Hill Landfill²	Kevin Coombes Avenue, Sydney Olympic Park	Landfill	Ongoing maintenance required to manage residual contamination (CLM Act)	1,000 metres north-east

¹site listed on the NSW EPA contaminated sites register: 1 current and 3 former notices

²site listed on the NSW EPA contaminated sites register: 1 current and 13 former notices

A search of the NSW *Protection of the Environment Operations Act 1997* register and NSW EPA PFAS Investigation Program Database on 30 March 2021 indicated there are no sites or PFAS investigation sites within one kilometre of the study area.

6.4.3 Potential impacts

Construction

Soil disturbance

Excavation and other earthworks such as regrading and vegetation removal and stockpiling activities, if not adequately managed, could result in the following impacts:

- erosion of exposed soil and stockpiled materials
- dust generation from excavation and vehicle movements over exposed soil
- increase in sediment loads entering the stormwater system and/or local runoff.

These impacts are expected to be minor due to the limited level of ground disturbance required for the Proposal and the relatively flat topography and stability of the study area.

Contamination

The Proposal has the potential to expose contaminants, which if not appropriately managed, can present a health risk to construction workers and the community. The exposure of contaminants could also pose an environmental risk if they were to enter nearby waterways through the stormwater infrastructure.

It is noted that works likely to result in lowering of the water table and/or below the natural ground surface at the site would require development consent from Auburn City Council and preparation of an ASS management plan.

The following are identified potential contaminant sources that may have an impact from the Proposal:

- possible historical fill material beneath the study area
- a history of chemical manufacture
- road related runoff along Parramatta Road and Hill Road

- potential pesticide use along the road reserve
- potential illegal waste dumping on the road reserve and on Transport for NSW land
- possible leaks/spills of oil/petrol and/or refrigerants and industrial chemicals from manufacturing and vehicle activity and parked machinery on sections of the Proposal.

Potential risks related to potential contaminants are low to moderate and may include:

- direct (skin/dermal) contact and injection (swallowing) potentially contaminated soils and groundwater
- hydrocarbon vapour inhalation from impacted soil and/or groundwater into the indoor air space
- contaminant flora uptake (bioaccumulation)
- transport of dissolved contaminants (pollutants) to the surface and groundwater.

Appropriate mitigation measures would be implemented to manage any hazardous substances encountered during construction of the Proposal as detailed in Section 6.4.4.

Operation

There would be no contamination impacts and ongoing operational risks to geology and soils from the Proposal during operation.

6.4.4 Safeguards and management measures

Table 6-11: Contamination, geology and soils safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Contaminated land	<p>A Contaminated Land Management Plan would be prepared in accordance with the <i>Guideline for the Management of Contamination</i> (TfNSW, 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>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Contaminated land	If contaminated areas are encountered during construction, appropriate control measures would be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area would 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 Transport for NSW Environment Manager and/or EPA.	Contractor	Detailed design / Pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>
Contaminated land	An Asbestos Management Plan would be developed for the construction of the Proposal in accordance with the National Environment Protection (Assessment of site contamination) Measure 1999. The Plan would include an unexpected finds procedure to address any previously unidentified asbestos contamination encountered during construction.	Contractor	Pre-construction	Additional safeguard
Accidental spill	A site specific emergency spill plan would be developed, and include spill management measures in accordance with the Transport for NSW <i>Code of Practice for Water Management</i> (RTA, 1999) and relevant EPA guidelines. The plan would address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport for NSW and EPA officers).	Contractor	Detailed design / Pre-construction	Section 4.3 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Excavation	Excavated material that is not suitable for onsite reuse or recycling would be transported to a site that may legally accept that material for reuse or disposal. Soils leaving the site will be waste classified so that correct resource recovery and or off-site disposal occur.	Contractor	Construction	Additional safeguard
Excavation	Where excavated material cannot be classified as virgin excavated natural material, it would be classified and disposed of to an appropriately licensed landfill in accordance with the Waste Classification Guidelines–Part 1: Classifying Waste and Part 2: Immobilisation of Waste.	Contractor	Construction	Additional safeguard

6.5 Traffic and transport

A *Transport Impact Assessment* (TIA), which assesses the existing environment, and impacts of the Proposal on the surrounding road, pedestrian and public transport network was prepared by Stantec in September 2021 (Stantec, 2021). This section provides summary of the key findings of the TIA (refer to Appendix G).

6.5.1 Methodology

The TIA considered:

- existing traffic and transport conditions within the Proposal’s study area
- relevant government policy, guidelines and strategies
- current and future performance of roads and intersections in the study area
- traffic and transport modelling for key scenarios, including:
 - existing road conditions – using 2019 traffic data to assesses the current road network and provides a baseline.
 - existing conditions with the upgrades outlined in the Proposal (refer to Section 3.1)
 - future conditions with a do minimum approach (in the years 2026 and 2036), which examines future traffic demand with the current road network.
 - future traffic demand with the upgrades outlined in the Proposal (in the years 2026 and 2036).
- traffic and transport impacts as a result of the Proposal by:
 - reviewing the project objectives to develop an optimal solution for the Proposal adopting traffic engineering and planning techniques
 - gaining an appreciation of the current operating conditions in the area surrounding the Proposal for all transport modes
 - assessing the immediate road network impacts with and without the Proposal for opening day and future horizon year scenarios.

The study area of the TIA is the Proposal as shown in Figure 6-6. Further details of the methodology including modelling criteria, level of service (LOS) and network statistics are in Chapter 4 of Appendix G.

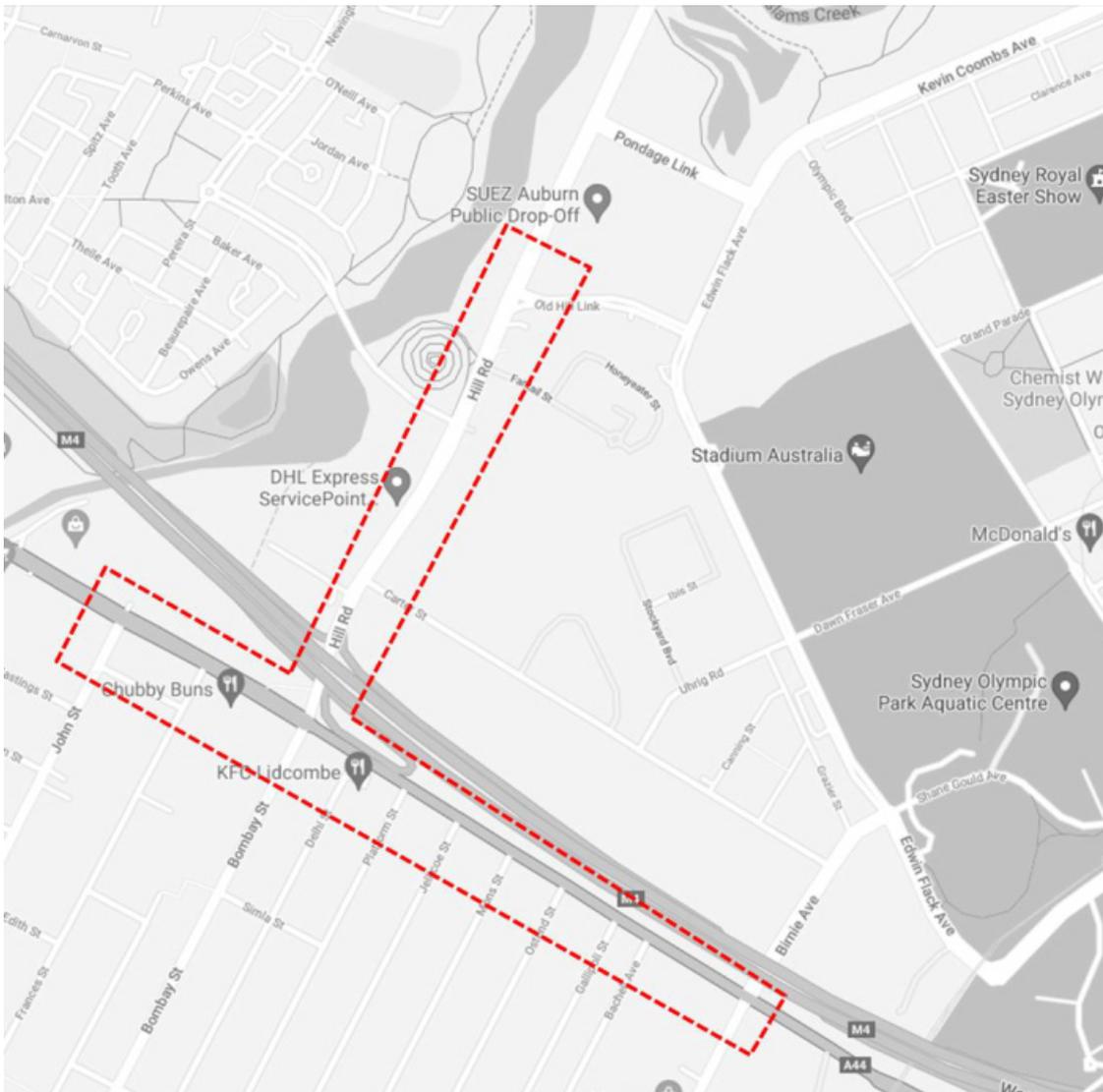


Figure 6-6: Transport Impact Assessment study area

6.5.2 Existing environment

Road network

Key road networks in the area are the M4 Motorway, Parramatta Road, Carter Street and Hill Road, with major influences of the network being the performance of the M4 Motorway and Parramatta Road corridor.

- the M4 Motorway is a two-way, eight lane freeway with generally aligned in an east-west direction and acts as one of the primary routes to the Sydney CBD and as an alternative route to Parramatta Road.
- Parramatta Road is generally aligned in an east-west direction and acts as a primary route to the Sydney CBD as an alternate to the M4 Motorway
- Hill Road is generally aligned in a north-south direction providing access to Sydney Olympic Park, Wentworth Point, Newington via John Ian Wing Parade. Hill Road acts as an alternative route between Silverwater Road and Parramatta Road.

The typical traffic conditions of the study area during peak times (refer to Figure 6-7 and Figure 6-8) are:

- moderate traffic conditions are experienced during the AM peak:
 - on Parramatta Road in both directions
 - on Hill Road southbound approaching the Hill Road and Parramatta Road intersection
 - for vehicles exiting Carter Street
 - for vehicles exiting M4 Motorway off ramp.
- moderate traffic conditions are experienced during the PM peak:
 - for vehicles exiting Carter Street
 - on Hill Road in both directions
 - for vehicles exiting M4 Motorway off ramp
- slow traffic conditions experienced during the PM peak on Parramatta Road in both directions, most notably to the west of the Parramatta Road and Hill Road intersection.

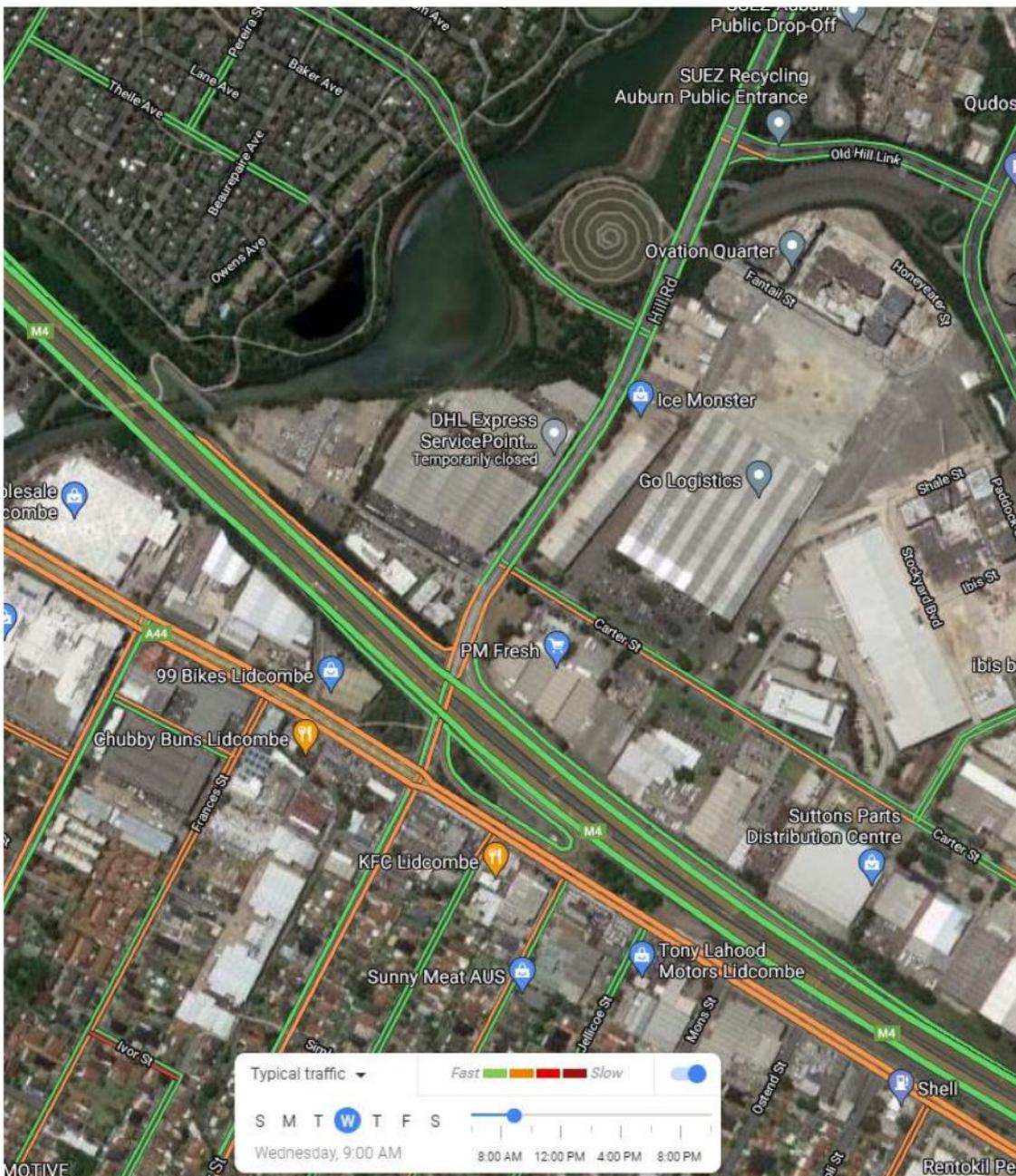


Figure 6-7: Typical weekday AM Peak (9:00am) Traffic Conditions

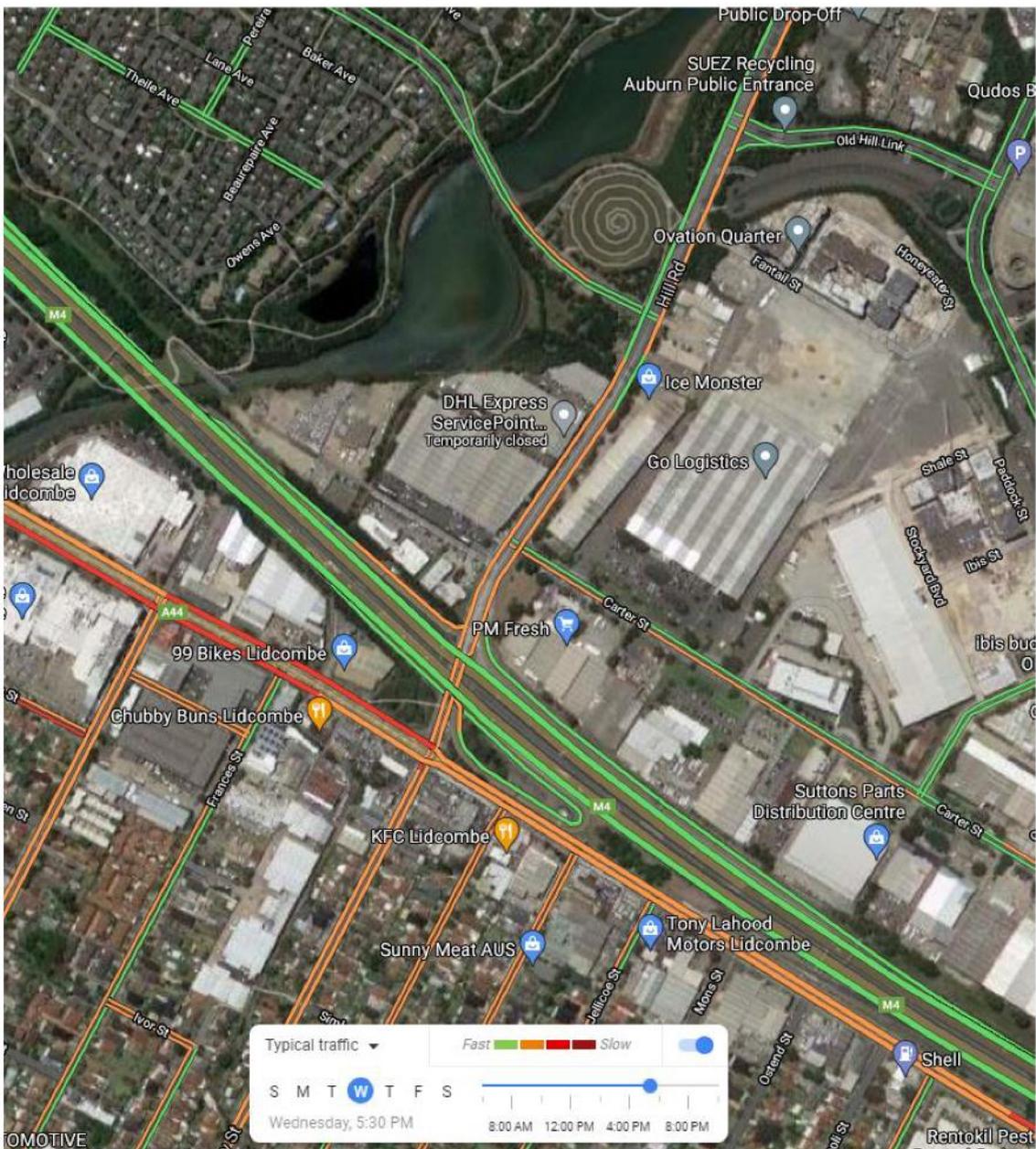


Figure 6-8: Typical weekday PM Peak (9:00am) Traffic Conditions

These roads are also classified as B-Double routes where there is a high percentage of heavy vehicles on Carter Street from the surrounding industrial and commercial businesses in the area. At the AM peak period, heavy vehicle usage at the intersection of Hill Road and Carter Street was up to 35% in 2019.

Existing road network and Intersection performance

Overall road network performance of the existing study area was assessed for this Proposal. Traffic data collected in 2019 was selected as the base year due to the timing of the most recent data collection and pre-COVID-19 traffic conditions which provide a more accurate representation of typical weekday traffic conditions.

Intersections of the study area are summarised in Table 6-12. The signalised intersections in the study area have been assessed using the LOS metric. The LOS is based on the average approach delay as per the Transport for NSW classification (refer to Table 6-13)

Table 6-12: Intersections in the study area

Intersection	Existing intersection type
Parramatta Road and John Street	Signalised
Parramatta Road and Birnie Avenue	Signalised
Parramatta Road, Hill Road and Bombay Street	Signalised
Hill Road and M4 eastbound on ramp	Priority controlled
Hill Road and M4 westbound off ramp	Priority controlled
Hill Road and Carter Street	Priority controlled
Hill Road and John Ian Wing Parade	Signalised
Hill Road and Old Hill Link	Signalised

Table 6-13: LOS criteria – Average Delay

LOS	Average delay (seconds)	
	From	To
A	0	14.5
B	14.5	28.5
C	28.5	42.5
D	42.5	56.5
E	56.5	70.5
F	70.5	9,999.0

The network statistics indicate that the road network in the study area is operating above capacity, with a network LOS F and E for the AM and PM peak periods and a degree of Saturation (DOS) of 1.7 and 1.1 during AM and PM peaks respectively.

The following are key findings of the existing intersection performance during AM and PM peak periods:

- AM peak:
 - LOS A to C: Old Hill Link, John Ian Wing Parade, M4 EB on ramp and M4 EB off ramp
 - LOS D: Parramatta Road and John Street intersection
 - LOS F: Hill Road and Carter Street, Hill Road and Parramatta Road, Parramatta Road and Birnie Avenue intersections
- PM peak:
 - LOS A to C: Old Hill Link, John Ian Wing Parade, M4 EB on ramp and M4 EB off ramp
 - LOS E to F: Hill Road and Carter Street, Parramatta Road and John Street and Parramatta Road and Birnie Avenue intersections.

The intersection performance at the AM and PM peak periods are shown in Figure 6-9 and Figure 6-10.

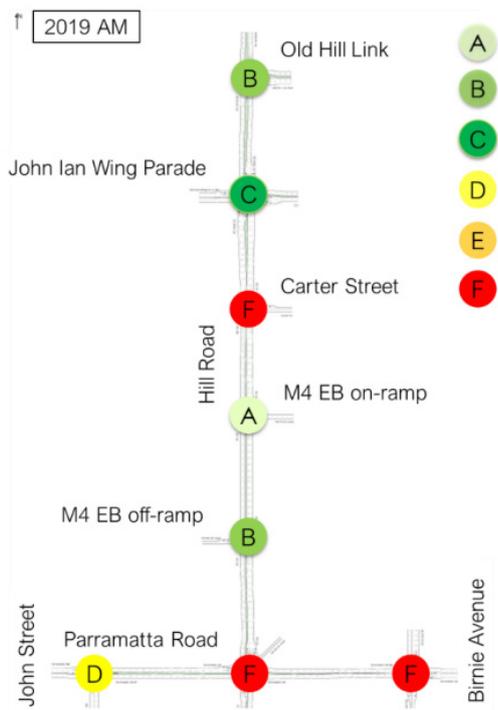


Figure 6-9: AM peak intersection performance

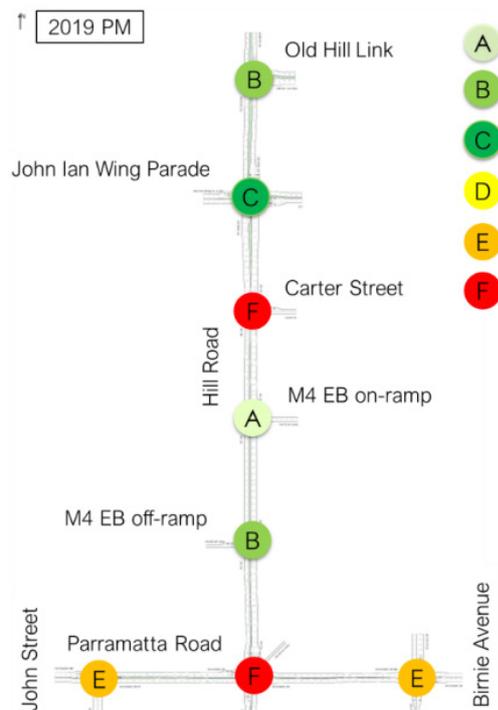
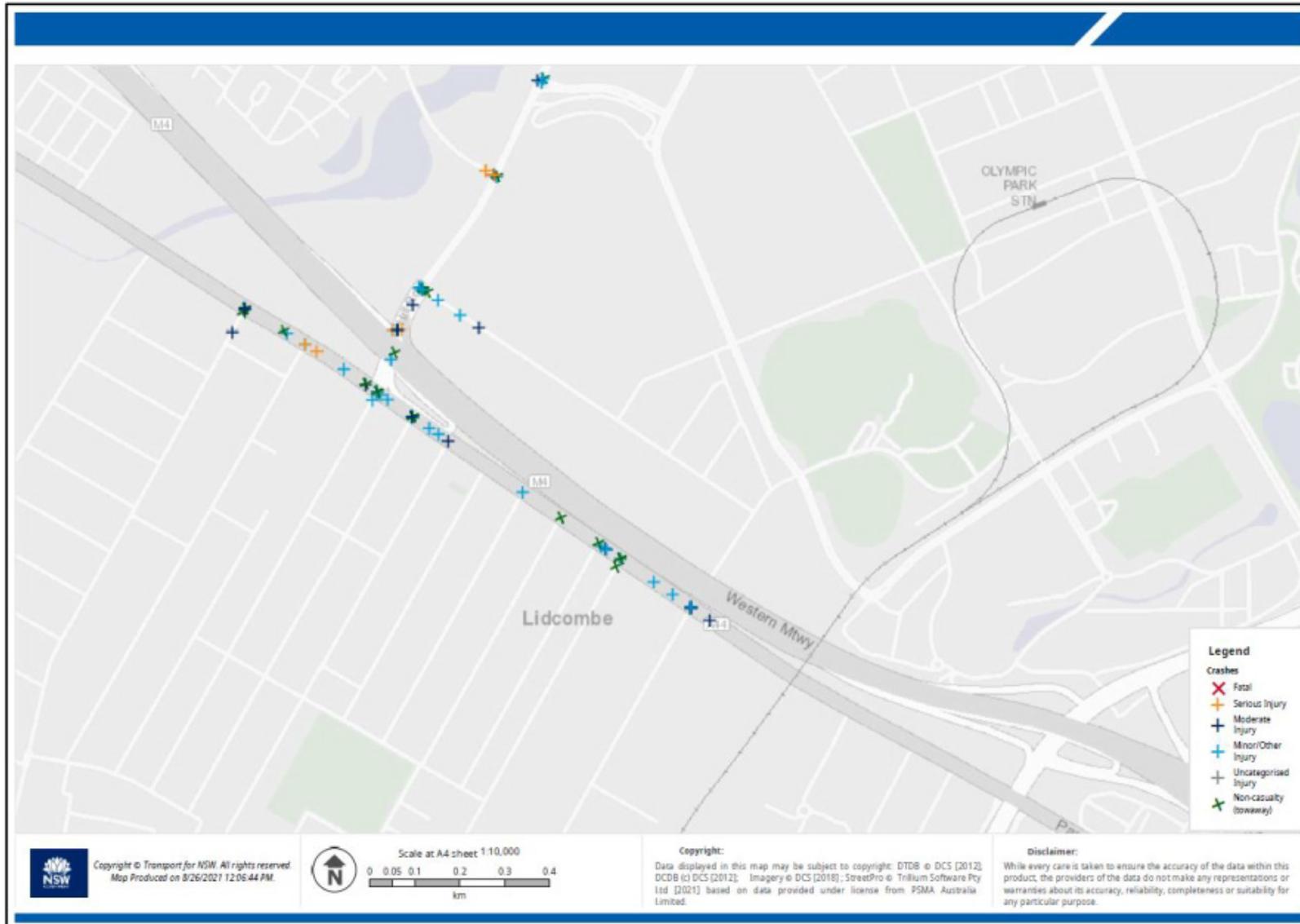


Figure 6-10: PM peak intersection performance

Road safety

Reported accident casualty history between 2016 and 2020 was reviewed in the NSW accident database for the roads and intersections in the area (TfNSW, 2021). There were 116 accidents and 113 casualties that occurred in the five-year time frame. The casualties identified are classified as 13 seriously injured, 36 moderately injured and 64 minor/other injured.

It is noted that there was a high proportion of accidents that occurred at the Hill Road and Carter Street intersection as shown in Figure 6-11.



Source: TfNSW 2021

Figure 6-11: Casualty accident history

Parking

The study area is highly urbanised with multiple commercial and industrial business with its own dedicated parking facility. Street parking is located generally along Bombay Street and Carter Street.

Public transport

Public transport options in the study area are detailed below and shown in Figure 6-12:

- Bus route #401: Sydney Olympic Park to Lidcombe
- Bus route #525: Parramatta to Burwood via Sydney Olympic Park
- Bus route 526: Rhodes Shopping Centre to Burwood
- T7 train: Olympic Park Line.

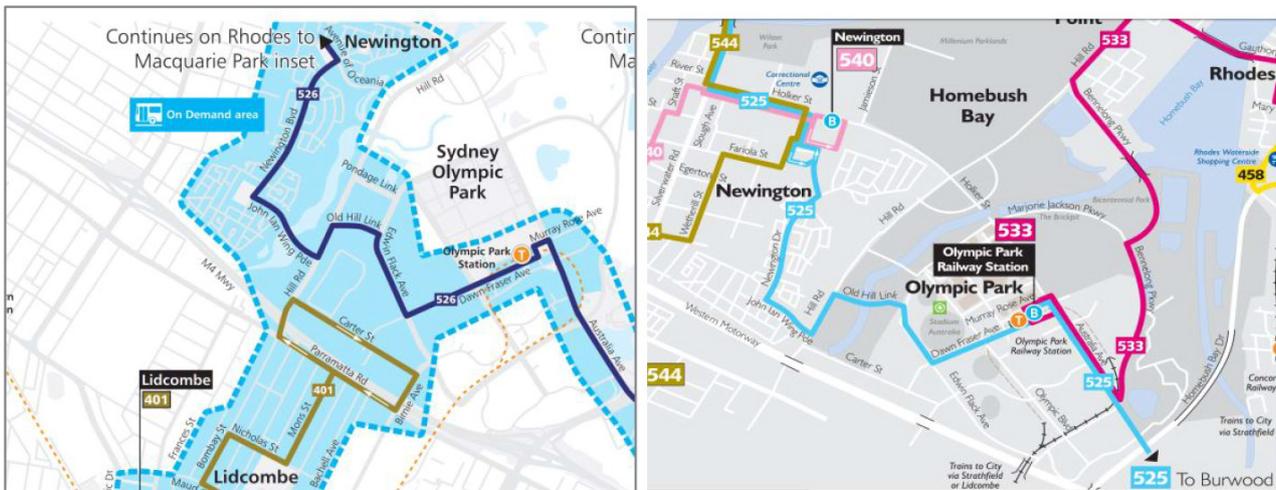


Figure 6-12: Public transport routes

Active transport

Active transport routes in the study area, include pedestrian and bicycle facilities. The majority of the roads within the study area include pedestrian paths on both sides of the Proposal.

The following are designated crossing facilities:

- signalised pedestrian crossings on the eastern and southern legs of the Parramatta Road and John Street intersection
- signalised pedestrian crossings on the western and southern legs of the Parramatta Road, Hill Road and Bombay Street intersection
- the zebra crossing on the western leg of the M4 eastbound off ramp and Hill Road intersection
- signalised pedestrian crossings on the western and northern legs of the Hill Road and John Ian Wing Parade intersection
- signalised pedestrian crossing on the eastern leg of the Hill Road and Old Hill Link intersection
- signalised pedestrian crossings on the eastern and southern legs of the Hill Road and Pondage Link intersection.

Existing bicycle facilities within the study area are shown in Figure 6-13 and include:

- a SUP along Hill Road, Birnie Avenue and Parramatta Road (east toward Birnie Avenue)
- an on-road facility along Bombay Street, west of Carter Street, John Ian Wing Parade and Old Hill Link Road.

There is also a proposed cycle network as part of the Carter Street Precinct with a new SUP along the western side of Hill Road between Parramatta Road and Carter Street and on the eastern side of Hill Road between Carter Street and Stockyard Boulevard.

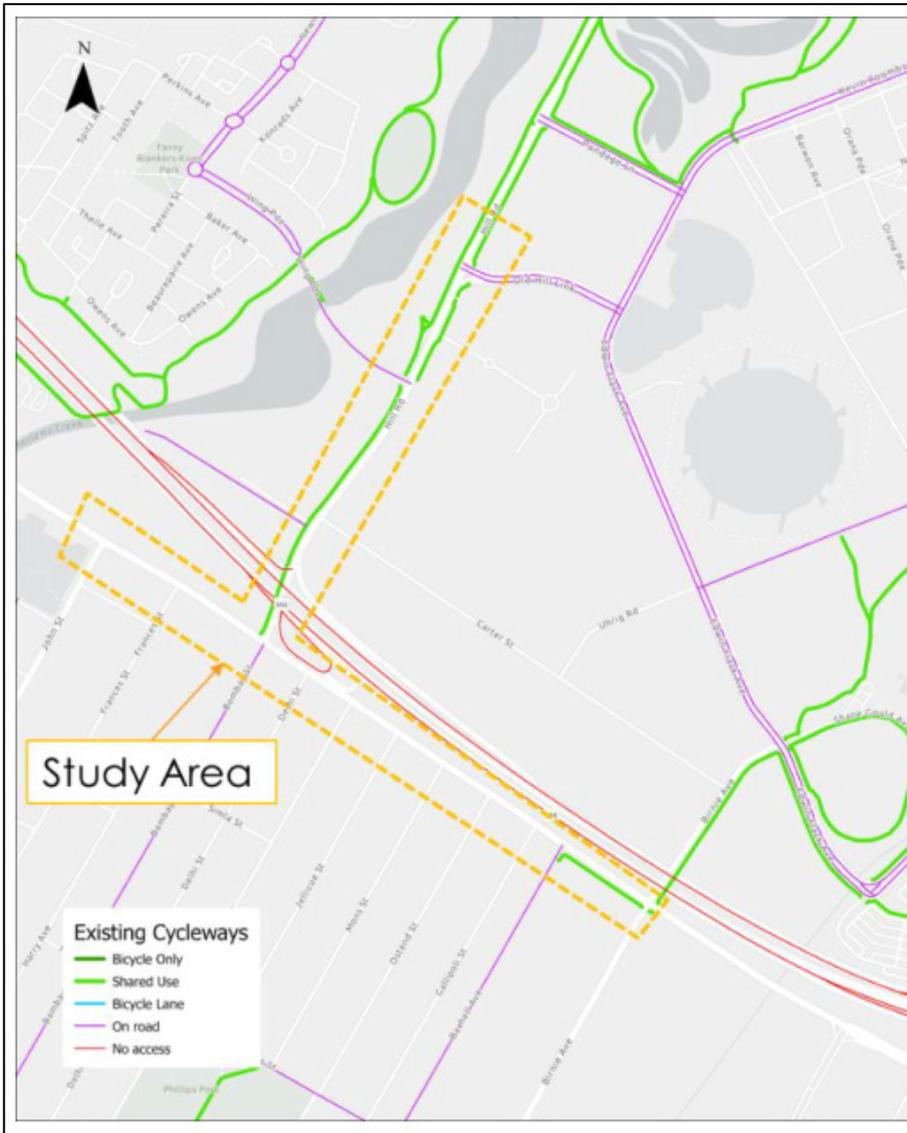


Figure 6-13: Existing bicycle network

Event day conditions

As Hill Road is a major north-south connector into Sydney Olympic Park, the Proposal functions as a key road to and from the area during event days. There are about 20 sporting and entertainment events year. Each event adopts a traffic management strategy to accommodate the additional demand. While most patrons travel to venues via public transport (69-85%), a significant number still travel via private vehicle. This can result in an additional 5,000-7,000 vehicles using the Sydney Olympic Park road network to attend event.

Details of major events are in Section 9.2 of Appendix G.

6.5.3 Potential impacts

Construction

Traffic and road access

Construction of the Proposal would take about 18 months and require various road and lane closures across the study area. During this period, access would be maintained throughout the study area. Construction activity for the Proposal would largely be confined to the Hill Road corridor itself, with minor disruptions (e.g. traffic delays resulting in increased travel time) to Parramatta Road due to intersection upgrades and the widening of the east bound off ramp M4 Motorway.

During construction of the Proposal, increased traffic, and road and land closures would impact the road network performance on Hill Road, along with service and access roads for the haulage of construction materials and service vehicles.

Activities which are likely to have a major impact on the network performance would be undertaken outside of peak hours or at night.

Traffic and road access would be mitigated through appropriate traffic management planning and are further described in Section 6.5.4.

Parking

The Proposal would not result in a significant loss of street parking as there would be a total of five car parking spaces removed on Bombay Street southern approach to Parramatta Road for upgrades at this intersection.

Public transport

Construction of the Proposal is expected to have a minor impact on public transport in the study area and result in increased travel times along Hill Road and Parramatta Road for bus routes 401, 525 and 526.

During construction along Carter Street, bus route 401 would not be able to turn into Carter Street from Hill Road (noting this would also be a permanent impact during operations). Bus operators and Transport for NSW would be consulted through detailed design and construction.

Active transport

Construction of the Proposal is expected to have a minor impact on active transport routes in the study area, including a temporary loss of on-road cycle lanes on John Ian Wing Parade and Old Link Road. Measures to minimise conflicts and interactions of active transport and construction would be managed through mitigation measures as detailed in Section 6.5.4.

Event day impacts

During construction of the Proposal, event day impacts to traffic access and road performance would worsen LOS compared to existing conditions (as shown in Figure 6-9 and Figure 6-10) from the increase of vehicles and attendees as well as the Proposal's construction at night and off-peak periods which are typically event days at Sydney Olympic Park.

It should be noted that each event adopts a traffic management strategy to accommodate the additional demand. Event day impacts during construction of the Proposal would be further consulted with SOPA and refined during the detailed design process and construction phase.

Refer to Section 6.5.4 for recommended safeguards and management measures.

Operation

Traffic and road access

The Proposal would generally improve the road network performance as there would be an improvement in average speed up to 10km/h in the AM peak and reduced delays along Hill Road and the Carter Street and Hill Road intersection with an improvement of LOS F to LOS C.

The Proposal would offer satisfactory intersection performance at the Hill Road intersections at Old Hill Link Road, John Ian Wing Parade, M4 Motorway eastbound on ramp and M4 Motorway eastbound off ramp primarily maintaining existing LOS performance. Traffic performance at the intersections along Parramatta Road are expected to remain heavily congested operating at LOS E or F.

Summary of LOS changes compared between existing and operations of the study area are in Table 6-14.

Overall, traffic impact performance would be minor as the Proposal would improve the road network performance along Hill Road, maintain satisfactory performance for local road intersections along Hill Road and maintain existing performance along Parramatta Road.

Table 6-14: Summary of LOS changes of the study area

Intersection	Level of Service (LOS)			
	2019 AM	2036 AM	2019 PM	2036 PM
Old Hill Link and Hill Road	B	C	B	C
John Ian Wing Parade and Hill Road	C	C	C	D
Carter Street and Hill Road	F	C	F	C
M4 eastbound on ramp and Hill Road	A	A	A	A
M4 eastbound off ramp and Hill Road	B	C	B	B
John Street and Parramatta Road	D	E	E	F
Bombay Street and Parramatta Road	F	F	F	F
Birnie Avenue and Parramatta Road	F	F	E	F

The Proposal would result in changed access arrangements for the commercial and industrial properties on the east and west side of Hill Road. There would be a continuous median between Hill Road and Parramatta Road as well as Hill Road and John Ian Wing Parade intersections removing right turn access into and out of streets and properties along Hill Road allowing only left-in/left-out access.

The Proposal would provide a stub for Stockyard Boulevard, at the Hill Road and John Ian Wing Parade intersection. The remainder of the Stockyard Boulevard is expected to be completed by either Council or the developer of the Carter Street Precinct. The traffic performance modelling has been completed on the final solution of a complete Stockyard Boulevard connecting to Hill Road and the Carter Street Precinct road network.

For properties on the east side of Hill Road, vehicles travelling northbound would have about a 1.5 kilometre alternate route. Vehicles would initially travel southbound on Hill Road, perform a series of left turns onto Carter Street, Uhrig Road or Edwin Flack Avenue, and then take either John Ian Wing Parade, Old Hill Link or Pondage Link. Properties on the west side of Hill Road would have about a 1.6 kilometre alternative route.

Vehicles travelling southbound would turn left along Hill Road and right at John Ian Wing Parade, Old Hill Link or Pondage Link in order to travel through the Sydney Olympic Park road network to travel southbound (e.g. Carter Street, Birnie Avenue or Australia Avenue).

The Proposal would also have an impact to B-Double vehicle access and movements in the area as heavy vehicles would use Birnie Avenue to access the Carter Street Precinct or continue using Hill Road southbound and make a left turn into Carter Street. The new Stockyard Boulevard extension would have a higher mass limit restriction having consideration for the proposed residential and school land uses within the Carter Street Precinct, therefore prohibiting access to B-Double vehicles.

Light and heavy vehicle impacts are minor as the Proposal would mostly provide improvements in the area as well as there are viable alternative routes with minimal traffic impacts.

Parking

The Proposal's upgrade at the Bombay Street, Parramatta Road and Hill Road intersection would remove a total of five car parking spaces. This is not expected to impact parking demands or facilities in the vicinity of the study area.

Public transport

During operations, bus route 401 would require a permanent route change as it would not be able to turn right into Carter Street. Due to the removal of the right turn from the Proposal, bus route 401 would be required to either turn right at Old Hill Link or at John Ian Wing Parade. Rerouting of this bus route is anticipated to provide safer controlled right turn movements as compared to the existing uncontrolled intersection at Carter Street.

Active transport

The Proposal would provide a benefit to active transport by improving the existing pedestrian and bicycle facilities with the SUP providing enhanced connectivity in the area and increased safety.

Event day impacts

Once operational, the Proposal would provide capacity improvements for event days at the Sydney Olympic Park improving traffic delays and queuing. It is expected that during significant events congestion levels are likely to increase compared to typical travel conditions (mainly in the PM peak) but would be temporary and return to normal conditions when event traffic dissipates.

Bus routes 525 and 526 are also likely to be impacted on event days as those routes traverse a small section of Hill Road between John Ian Wing Parade and Old Hill Link in the northbound direction. Bus operators and Transport for NSW would be consulted in the planning phase of each event day. Traffic impacts to bus routes would be similar to the same levels of delays as general traffic.

Traffic management plans would be developed and managed with SOPA to best cater for these events. Refer to Section 6.5.4 for recommended safeguards and management measures.

6.5.4 Safeguards and management measures

Table 6-15: Traffic and transport safeguards and management measures

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 Transport for NSW <i>Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10 Control of Traffic</i> (TfNSW, 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. 	Contractor	Detailed design / Pre-construction	Section 4.8 of QA G36 <i>Environment Protection</i>
Traffic and transport	Where possible, current traffic movements and property access are to be maintained during the works. Any disturbance is to be minimised to prevent unnecessary traffic delays.	Contractor	Construction	Additional safeguard
Traffic and transport	Comply with Council requirements regarding traffic control, access and road/ pedestrian access.	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Event Day traffic	<p>The following measures would be applied during event day traffic:</p> <ul style="list-style-type: none"> • consultation with SOPA • where possible, current traffic movements and property access are to be maintained during the event. Any disturbance is to be minimised to prevent unnecessary traffic delays • if traffic disturbance is unavoidable, a TMP would be prepared. 	SOPA	Construction & Operation	Additional safeguard

6.6 Noise and vibration

This section describes the Noise and vibration impacts associated with the Proposal. A *Noise and vibration impact assessment* (NVIA) (WSP, 2021c) was prepared to assess the potential noise and vibration impacts of the Proposal.

The following section is a summary of the key findings of the NVIA. Full details of the assessment are in Appendix H.

6.6.1 Methodology

The construction noise and vibration assessment was carried out with reference to the:

- *Interim Construction Noise Guideline* (DECC, 2009)
- *Roads and Maritime Construction Noise and Vibration Guideline and Assessing vibration, a technical guideline* (DEC, 2006).

Operational road traffic noise has been assessed according to the *Road Noise Policy* (RNP) (EPA, 2011). The application of the RNP guidelines as set out in the *Noise Criteria Guideline* (NCG, RMS, 2015) has been used. Receivers identified to exceed the NCG criteria have been considered for mitigation in accordance with the *Noise Mitigation Guideline* (NMG, RMS, 2015) as well as the *Environment Noise Management Manual* (ENMM, RMS, 2001).

The noise and vibration assessment of the Proposal included:

- identifying a noise and vibration assessment study area
- a review of relevant legislation and guidelines
- determining the background noise levels using previous assessments undertaken near the Proposal
- identifying noise and vibration catchment areas, and sensitive receivers near the Proposal
- modelling and identifying impacts of the construction and operations of the Proposal on noise and vibration-sensitive receivers near the Proposal
- recommending safeguards and management measures.

6.6.2 Existing environment

Background noise modelling

Ambient background noise levels were assessed for the Proposal using unattended and operator-attended noise monitoring devices from previous assessments undertaken near the Proposal. Noise monitoring locations are summarised in Table 6-16 and shown on Figure 6-15.

Table 6-16: Noise monitoring locations

ID	Noise monitoring location
A1.2	6 Welfare Street, Homebush
A1.3	3 Courallie Avenue, Homebush West
A2.1	135 Delhi Road, Lidcombe
A2.2	8 Spritz Avenue, Newington
A2.3	21 Barker Avenue, Silverwater

Noise assessment study area

The study area of the Proposal was divided into seven noise catchment areas (NCAs) which is based on areas with similar noise environments. The identified NCAs contain a mixture of commercial receivers, residential receivers, outdoor recreation areas (passive and active) and a single primary school.

NCAs extend as far back from the Proposal as is required to ensure all areas of lower background noise are included and therefore, worst case construction noise impacts would be identified. This ensures that the determined mitigation measures would address impacts at all receivers.

Table 6-17 provides a summary of NCAs, the location of NCAs is shown on Figure 6-14. Refer to Section 5.1.2 of Appendix H for further details.

Table 6-17: Noise catchment areas

NCA	Description
NCA.A01_02N	Commercial receivers and open space north of the M4 Motorway between Bellona Avenue, Sydney Olympic Park and Birnie Avenue, Sydney Olympic Park.
NCA.A01_02S	Commercial receivers south of the M4 Motorway between Kanoona Avenue, Homebush West and Bachell Avenue, Lidcombe.
NCA.A02_01	Residential receivers south of the M4 Motorway between Bachell Avenue, Lidcombe and the canal to the west of Bombay Street, Lidcombe.
NCA.A02_02N	Commercial, residential, educational and outdoor recreation areas receivers north of the M4 Motorway between Birnie Avenue, Lidcombe and Haslams Creek, Lidcombe. Note: Including Carter Street Precinct receivers
NCA.A02_02S	Commercial receivers immediately south of the M4 Motorway between Bachell Avenue, Lidcombe and Haslams Creek, Lidcombe. Residential receivers south of the M4 Motorway between the canal to the west of Bombay Street, Lidcombe and Nyrang Street, Lidcombe.

NCA	Description
NCA.A02_03N	Residential receivers north of the M4 Motorway between Haslams Creek, Newington and Stubbs Street, Silverwater.

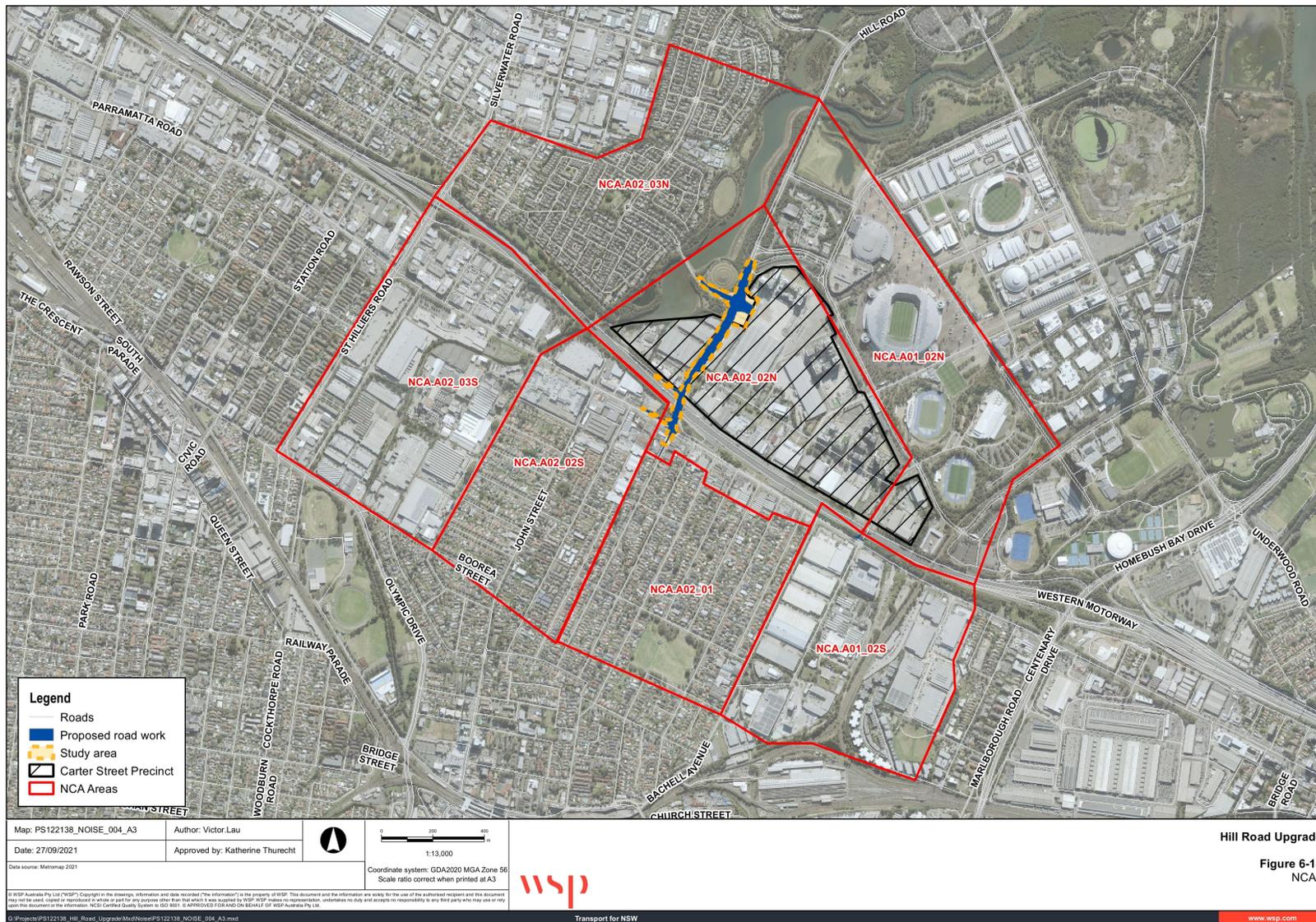


Figure 6-14: Noise catchment areas

Surrounding land use, sensitive receivers, local heritage items

The environment within and around the Proposal is considered to be urban with the dominant noise source being road traffic from the exiting and adjacent M4 Motorway as well as vehicle movements on Hill Road and Parramatta Road. There are a number of sensitive receivers located near the Proposal which have been classified based on their occupancy and use as defined in the ICNG and Noise Policy for Industry guidelines. Properties identified as requiring acquisition (refer to Section 3.5) are excluded from the assessment, however the Carter Street Precinct currently under development, and located adjacent to the Proposal has been included in the assessment.

The locations of sensitive receivers are shown in Figure 6-15 and include:

- commercial receivers which are mainly located adjacent to the southern portion of the Proposal on Parramatta Road and Hill Road (the nearest located 10 metres from the Proposal),
- residential receivers to the south of the Proposal, located beyond the commercial properties along Parramatta Road.
- residential receivers (existing and to be constructed in the future) within the Carter Street Precinct directly adjacent to the Proposal on Hill Road to the north of the M4 motorway
- educational receivers (around 150 metres to the east of the Proposal) and
- active and passive recreation receivers immediately adjacent to the northern end of the Proposal.

It should be noted at the time of this assessment, the Carter Street Precinct was not completed yet with only some residential buildings completed and/or in construction. They have been identified as part of existing conditions as part of this assessment and listed in Figure 6-15.

There are no vibration-sensitive heritage buildings identified within one kilometre of the Proposal. As described in Section 6.8, there is a local heritage item, Shale Gravel Transition Forest in the Sydney Basin, at the Parramatta Road and Hill Road intersection.

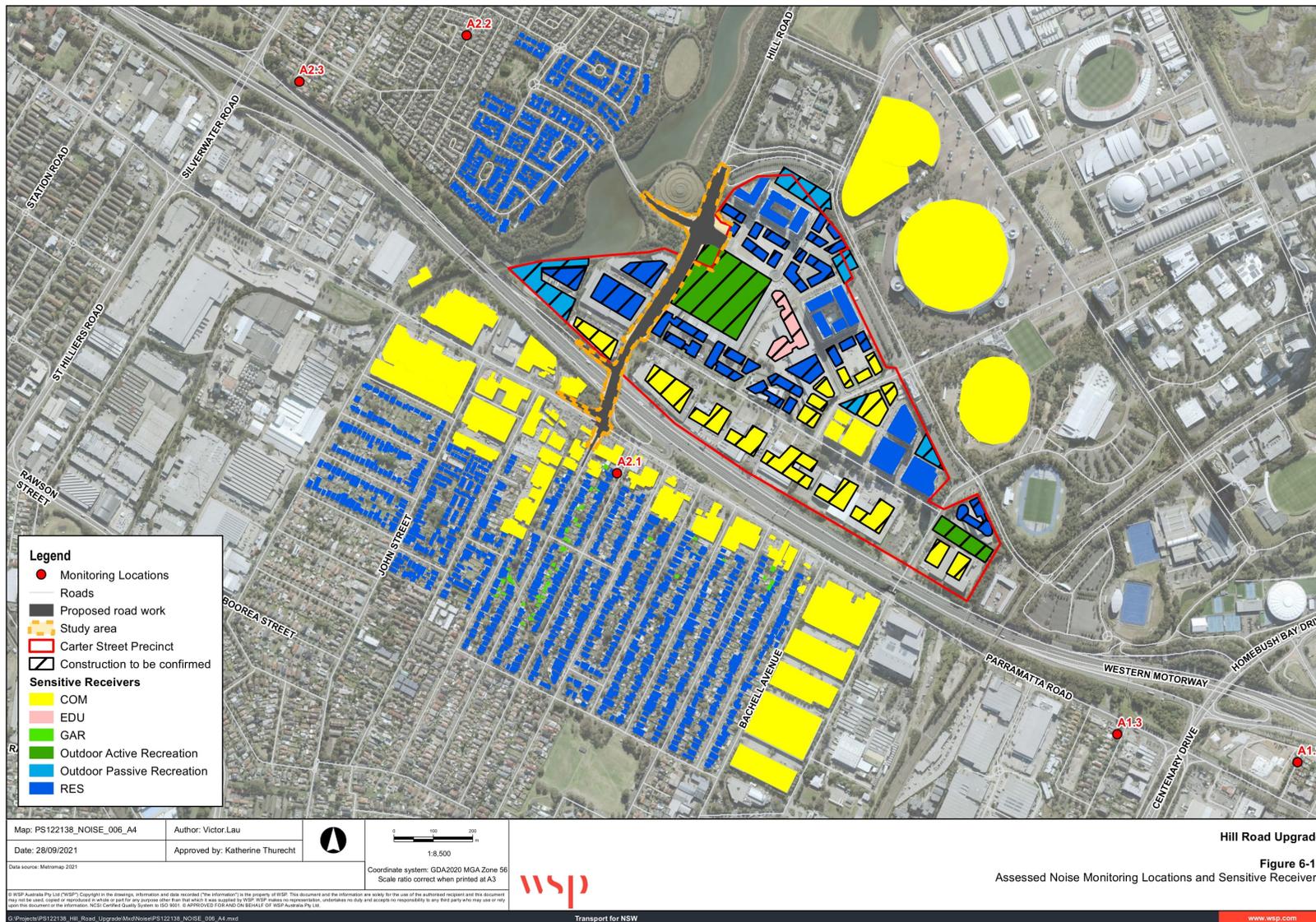


Figure 6-15: Noise monitoring locations and sensitive receivers

Background noise levels

The existing rating background levels (RBL) and traffic noise level as determined from unattended noise monitoring are summarised in Table 6-18.

Table 6-18: Summary of unattended noise logging results

Noise monitoring location	Noise level dBA				
	Background noise level ¹			Traffic noise level ²	
	Daytime RBL	Evening RBL	Night time RBL	Daytime L _{EQ(15HOUR)}	Night time L _{EQ(8HOUR)}
A1.2 ⁴	50	50	48	56	54
A1.3	56	54	50	61	58
A2.1	52	52	47	60	55
A2.2 ⁴	56	56	53	62	59
A2.3	55	52	49	59	56

(1) Interim Construction Noise Guidelines (ICNG) governing periods – Day: 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening: 6.00 pm to 10.00 pm; Night: 10.00 pm to 7.00 am Monday to Saturday, 10.00 pm to 8.00 am Sunday.

(2) Road Noise Policy (RNP) assessment time periods – Day: 7.00 am to 10.00 pm; Night: 10.00 pm to 7.00 am.

(3) Monitoring periods: Daytime (D) = 7am to 6pm, Evening (E) = 6pm to 10pm and Night-time (N) = 10pm to 7am.

(4) Monitoring location near to building facade. Measured noise levels considered to represent facade affected noise levels which are up to 2.5 dB higher than the equivalent free-field condition.

Noise monitoring locations A2.1 and A2.2 were used in this assessment as they represent the closest and most relevant locations to assess construction and operational noise. Noise management levels at residential receivers in the NCAs are summarised in Table 6-19.

Table 6-19: Noise management levels at residential receivers

NCA	Log ID	Receiver type	RBL ¹ dBA		
			Daytime	Evening	Night time
NCA.A01_02N_RES	A2.2	Residential	56	56	53
NCA.A02_01_RES	A2.1	Residential	52	52	47
NCA.A02_02N_RES	A2.2	Residential	56	56	53
NCA.A02_02S_RES	A2.1	Residential	52	52	47
NCA.A02_03N_RES	A2.2	Residential	56	56	53

(1) Daytime = 7am to 6pm, Evening = 6pm to 10pm and Night time = 10pm to 7am.

Assessment criteria

Construction hours

As described in Section 3.2.4, Transport for NSW would undertake construction during standard hours where it is feasible and reasonable to do. 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 Period 1 (OOHW1): Monday - Saturday 6:00pm to 10:00pm, Saturday 7:00am to 8:00am and 1:00pm to 10:00pm, and Sundays and public holidays 8:00am to 6:00pm
- Out of Hours Works Period 2 (OOHW2): Monday - Friday 10:00pm to 7:00am, Saturday 10:00pm to 08:00am, and Sundays and public holidays 6:00pm to 7:00am.

Some works, such as works within the road median and utility relocations, would likely be undertaken out of hours, to ensure safe work practices and to avoid unacceptable traffic or utility disruptions.

Construction noise management levels

The potential noise impacts from construction activities have been assessed using a quantitative approach in accordance with the ICNG.

The ICNG contains procedures for establishing NMLs at sensitive receiver locations based on the existing background noise in the area. Where an exceedance of the noise management levels is predicted, the ICNG advises that receivers can be considered ‘noise affected’ and the proponent should apply all feasible and reasonable work practises to minimise the noise impact. The proponent should also inform all potentially impacted residents of the nature of the works to be carried out, the expected noise level and duration, as well as contact details.

Residential receivers

Table 6-20 details the method for determining NMLs for residential receivers potentially affected by the proposal. Often works that may cause inconvenience within the community (e.g. traffic congestion) or safety concerns are done outside of standard work hours. NMLs during these periods are presented in the table for works ‘Outside recommended standard hours’.

Table 6-20: Recommended construction NMLs at residential receivers outlined in the ICNG

Time of day	Noise Management Level $L_{Aeq(15min)}$ ¹	How to apply
Recommended Standard hours: <ul style="list-style-type: none"> • Monday to Friday 7:00am to 6:00pm • Saturday 8:00am to 1:00pm 	Noise affected rating background level: <ul style="list-style-type: none"> • RBL + 10 dB(A) 	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practises to meet the noise affected level.

Time of day	Noise Management Level $L_{Aeq(15min)}^1$	How to apply
<ul style="list-style-type: none"> No work on Sundays or public holidays 	Highly Noise Affected: <ul style="list-style-type: none"> 75 dBA 	<p>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.</p> <p>The Highly Noise Affected (HNA) level represents the point above which there may be strong community reaction to noise.</p> <p>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restructuring the hours that the very noisy activities can occur, taking into account:</p> <p>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.</p> <p>If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.</p>
	Outside recommended standard hours	<p>Noise affected rating background level:</p> <ul style="list-style-type: none"> RBL + 5 dB(A) <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 practises have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.</p>

(1) $L_{Aeq(15min)}$ – the A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as from industry, road, rail and the community.

Table 6-21 have been established to assess the potential for noise impacts during construction.

Table 6-21: Construction NMLs at residential receivers established for the Proposal

NCA	NML dBA LEQ(15MIN)					
	Highly impacted	D ¹	D ¹	E ¹	E ¹	N ¹
		SH	OOHW 1	OOHW 1	OOHW 2	OOHW 2
NCA.A01_02N_RES	75	66	61	61	61	58
NCA.A02_01_RES	75	62	57	57	57	52
NCA.A02_02N_RES	75	66	61	61	61	58
NCA.A02_02S_RES	75	62	57	57	57	52
NCA.A02_03N_RES	75	66	61	61	61	58

(1) Daytime = 7am to 6pm, Evening = 6pm to 10pm and Night time = 10pm to 7am.

Non-residential receivers

A number of non-residential land uses have been identified in the study area. These include other sensitive land uses such as educational institutes, medical facilities, outdoor recreational areas and commercial properties. The ICNG also provides guidance for these types of receivers. Noise management levels recommended in the ICNG for non-residential receivers have been reproduced in Table 6-22. No separate criteria for out-of-hours construction works is provided for non-residential sensitive receivers as it is assumed that the buildings would be vacated during the evening and night time.

For certain receiver types, criteria presented in Table 6-22 is specified as an internal noise level. As the noise model predicts external noise levels, it has been conservatively assumed that all schools and places of worship have openable windows and external noise levels are 10 dB higher than the corresponding internal level, which is representative of windows being partially open to provide ventilation. Hospital wards are assumed to have fixed windows with 20 dB higher external levels.

Table 6-22: Recommended construction NMLs at non-residential receivers outlined in ICNG

Non-residential land use	Noise Management Level $L_{Aeq(15min)}$ ¹ (when property is in use) – dB(A)
Classrooms at schools and other education institutions	45 (Internal noise level)
Hospital wards and operating theatres	45 (Internal noise level)
Places of Worship	45 (Internal noise level)
Active recreation areas	65 (External noise level)
Passive recreation areas	60 (External noise level)
Community centres	Refer to the recommended 'maximum' internal levels in AS 2107 for specific uses
Commercial (offices, retail outlets and small commercial premises)	70 (External noise level)

(1) $L_{Aeq}(15\text{ min})$ – the A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as from industry, road, rail and the community.

Sleep disturbance

Construction activity during night periods (10:00pm-7:00am) has the potential to cause sleep disturbance in nearby residences. Where construction works are planned to extend over more than two consecutive nights, the ICNG recommends that an assessment of sleep disturbance impacts should be completed. The ICNG makes reference to the EPA's *Environment Criteria for Road Traffic Noise* (ECRTN), now superseded by the RNP, for assessment of sleep disturbance. The RNP references the recommendations in the ECRTN as providing the most appropriate assessment guidance.

The guidance provided in the RNP for assessing the potential for sleep disturbance recommends that to minimise the risk of sleep disturbance during the night-time period, the $L_{A1(1\text{ min})}$ noise level (the A-weighted sound pressure level that is exceeded for 1% of the 1-minute measurement period) outside a bedroom window should not exceed the $L_{A90(15\text{ min})}$ background noise level (the A-weighted sound pressure level that is exceeded for 90% of the 15-minute measurement period, when measured in the absence of the construction works excluding extraneous noise) by more

than 15 dB(A). If this sleep disturbance screening criterion is found to be exceeded, a more detailed assessment and response is required at the detailed design stage that should include the extent that the maximum noise level exceeds the background noise level and the number of times this is likely to happen during the night-time period.

Construction noise assessment criteria

Noise and vibration impacts from construction activities have been assessed with reference to the *Construction Noise and Vibration Guideline* and *Assessing vibration, a technical guideline* (DEC, 2006) (CNVG). The CNVG defines the assessment method and suggests noise management measures based on the length of the works, the number of people affected and the time the works occur.

For purposes of the construction noise assessment, seven modelled construction scenarios were identified based on the construction staging detailed in Table 3-2.

- **Early works:**
 - CA1 – construction compound site establishment
 - CA2 – corridor clearing
- **Stage 1 and 2:**
 - CA3 – retaining wall
 - CA4 – bulk earthworks
 - CA5 – drainage infrastructure
- **Stage 3:**
 - CA6 – paving/asphalting
 - CA7 – road furniture installation.

The construction of the Proposal is expected to take place during the recommended standard (NSW) Environment Protection Authority (EPA) construction hours. It is also anticipated that the out-of-hours work would be needed to manage safety and minimise traffic impacts. Details of recommended construction hours and out-of-hours works are described in Section 3.2.6.

Refer to the NVIA (Appendix H) for detailed criteria of assessment periods, Noise Management Levels (NML), sleep disturbance, plant and equipment, road traffic noise and vibration including for cosmetic building damage and human comfort (amenity).

Construction vibration criteria

Vibration arising from construction activities can result in impacts on human comfort, impacts on the building contents (such as sensitive equipment) or the damage to the physical structure of the building. These impacts have different criteria levels, with the effects of vibration on human comfort having a lower threshold.

Human comfort

Assessing Vibration: a technical guideline identifies three different forms of vibration associated with construction activities:

- Continuous: uninterrupted vibration occurring over a defined period.
- Impulsive: short-term (typically less than two seconds) bursts of vibration which occurs up to three times over an assessment period.
- Intermittent: interrupted periods of continuous or repeated impulsive vibration, or continuous vibration that varies significantly in magnitude.

Vibration from construction works tends to be intermittent in nature. *Assessing Vibration: a technical guideline* provides criteria for intermittent vibration based on the Vibration Dose Value

(VDV). The 'preferred' and 'maximum' VDV's for human comfort impacts are shown in Table 6-23 and Table 6-24.

Table 6-23: Preferred and maximum values for intermittent vibration (DECC, 2006)

Building type	Assessment Period	Vibration Dose Value ¹ (m/s ^{1.75})	
		Preferred	Maximum
Critical Working Areas (e.g. operating theatres or laboratories)	Day or night-time	0.10	0.20
Residential	Daytime	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational institutions and places of worship	Day or night-time	0.40	0.80
Workshops	Day or night-time	0.80	1.60

(1) The VDV accumulates vibration energy over the daytime and night-time assessment periods, and is dependent on the level of vibration as well as the duration.

Table 6-24: Preferred and maximum values for continuous and impulsive vibration (DECC, 2006)

Location	Assessment Period	Preferred values (m/s ²) 1–80 Hz		Maximum values (m/s ²) 1–80 Hz	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration					
Critical working areas ¹ (e.g. operating theatres or precision laboratories where sensitive operations are occurring)	Day or night-time	0.0050	0.0036	0.010	0.0072
Residential	Daytime	0.010	0.0071	0.020	0.014
	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 working areas ¹ (e.g. operating theatres or precision laboratories where sensitive operations are occurring)	Day or night-time	0.0050	0.0036	0.010	0.0072
Residential	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14

Location	Assessment Period	Preferred values (m/s ²) 1–80 Hz		Maximum values (m/s ²) 1–80 Hz	
		z-axis	x- and y-axis	z-axis	x- and y-axis
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

(1) No critical working areas have been identified in the study area. This should be confirmed during the detailed design stage.

Building contents

For most receivers, the human comfort vibration criteria are the most stringent and it is generally not necessary to set separate criteria for vibration effects on typical building contents. Exceptions to this can occur when vibration sensitive equipment, such as electron microscopes and microelectronics manufacturing equipment, are located in buildings near the construction works. Buildings with vibration sensitive equipment have not been identified near the Proposal.

Buildings and structures

If vibration from construction works is sufficiently high it can cause damage to structural elements of affected buildings such as cracks or loosening of drywall surfaces, cracks in supporting columns and loosening of joints. Structural damage vibration limits are contained in British Standard (BS) 7385 and German Standard DIN 4150.

The BS 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 6-25.

Table 6-25: BS 7385 structural damage criteria

Group	Type of structure	Damage level	Peak particle velocity (PPV) – millimetre per second (mm/s)	
			4Hz to 15Hz	15Hz and above
1	Reinforced or framed structures. Industrial and heavy commercial buildings	Cosmetic	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures. Residential or light commercial type buildings	Cosmetic	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

For heritage buildings, the BS 7385 states that “a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive”.

Guidance for more sensitive structures, such as residential buildings and buried pipework, is presented in the German Guideline DIN 4150. The DIN 4150 values for buildings and structures are shown in Table 6-26. As stated in BS 7385, heritage buildings and structures should not be assumed to be more sensitive to vibration, unless structurally unsound. Where a heritage building is deemed to be sensitive, the more stringent DIN 4150 Group 3 guideline values in Table 6-26 can be applied.

Table 6-26: DN4150 vibration guidelines for heritage buildings

Group	Type of structure	Guideline value for velocity - mm/s				
		Foundation, All Directions at a Frequency of			Topmost Floor, Horizontal	Floor Slabs, Vertical
		1 to 10 Hz	10 to 50 Hz	50 to 100 Hz	All frequencies	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	20
2	Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified as Group 1 or 2 <u>and</u> are of great intrinsic value (e.g. heritage listed buildings)	3	3 to 8	8 to 10	8	20 ¹

Minimum working distances

The CNVG provides minimum working distances to achieve human comfort criteria (from the NSW EPA Vibration Guideline) and cosmetic building damage criteria (from BS 7385 and DIN 4150) for a range of different plant and equipment. These have been reproduced in Table 6-27. Impacts on human comfort and the physical structure of buildings are considered unlikely at distances greater than the minimum working distances.

The construction activities listed in Table 6-27 occur at various stages in each construction zone as described in Section 3.2.4. As the final construction methodology and staging is refined further, the associated noise and vibration impacts, and associated safeguards and management measures, would be re-assessed as required.

Table 6-27: Recommended safe working distances for vibration-intensive plant and equipment (RMS, 2016)

Plant	Rating/description	Minimum distance (metres)		
		Cosmetic damage		Human Response (NSW EPA Guideline)
		Residential and Light Commercial (BS 7385)	Heritage Items (DIN 4150, Group 3)	
Vibratory roller	<50 kN (1–2 tonne)	5	11	15 – 20
	<100 kN (2–4 tonne)	6	13	20
	<200 kN (4–6 tonne)	12	15	40
	<300 kN (7–13 tonne)	15	31	100
	>300 kN (13–18 tonne)	20	40	100

Plant	Rating/description	Minimum distance (metres)		
		Cosmetic damage		Human Response (NSW EPA Guideline)
		Residential and Light Commercial (BS 7385)	Heritage Items (DIN 4150, Group 3)	
	>300 kN (>18 tonne)	25	50	100
Small Hydraulic Hammer	300 kg (5 to 12 t excavator)	2	5	7
Medium Hydraulic Hammer	900 kg (12 to 18 t excavator)	7	15	23
Large Hydraulic Hammer	1,600 kg (18 to 34 t excavator)	22	44	73
Vibratory Pile Driver	Sheet piles	2 – 20	5 – 40	20
Piling Rig – Bored	≤ 800	2 (nominal)	5	4
Jackhammer	Hand held	1 (nominal)	3	2

The minimum working distances are indicative and will vary depending on the particular item of equipment, the scope of the work and local geotechnical conditions.

Construction noise mitigation

The CNVG contains a number of standard mitigation measures for mitigating and managing construction impacts. The measures are shown in Appendix B of the Noise and Vibration Assessment and should be applied to the works where feasible and reasonable.

Where noise impacts remain after the use of standard mitigation measures, the CNVG requires the use of additional mitigation measures where feasible and reasonable. The trigger levels for implementing additional mitigation measures defined in the CNVG are shown in Table 6-28.

Table 6-28: CNVG triggers for additional mitigation measures – airborne noise (RMS, 2016)

Predicted $L_{Aeq(15\text{minute})}$ Airborne Noise Level at Receiver		Additional Mitigation Measures		
Perception	dBA above RBL	dBA above NML	Type ¹	Mitigation Levels ²
All hours				
75 dBA or greater			N, V, PC, RO	HNA
Standard Hours: Mon – Fri (7am–6pm), Sat (8am–1pm), Sun/Public Holiday (No work)				
Noticeable	5 to 10	0	-	NML
Clearly Audible	10 to 20	<10	-	NML
Moderately Intrusive	20 to 30	10 to 20	N, V	NML+10
Highly Intrusive	>30	>20	N, V	NML+20

Predicted $L_{Aeq(15\text{minute})}$ Airborne Noise Level at Receiver		Additional Mitigation Measures		
OOHW Period 1: Mon – Fri (6pm–10pm), Sat (7am–8am & 1pm–10pm), Sun/Public Holiday (8am–6pm)				
Noticeable	5 to 10	<5	-	NML
Clearly Audible	10 to 20	5 to 15	N, R1, DR	NML+5
Moderately Intrusive	20 to 30	15 to 25	V, N, R1, DR	NML+15
Highly Intrusive	>30	>25	V, IB, N, R1, DR, PC, SN	NML+25
OOHW Period 2: Mon – Fri (10pm–7am), Sat (10pm–8am), Sun/Public Holiday (6pm–7am)				
Noticeable	5 to 10	<5	N	NML
Clearly Audible	10 to 20	5 to 15	V, N, R2, DR	NML+5
Moderately Intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR	NML+15
Highly Intrusive	>30	>25	AA, V, IB, N, PC, SN, R2, DR	NML+25

(1) N = Notification, SN = Specific Notification, PC = Phone Calls, IB = Individual Briefings, R1 = Respite Period 1, R2 = Respite Period 2, RO = Project Specific Respite Offer, DR = Duration Respite, AA = Alternative Accommodation, V = Verification.

(2) NML = Noise Management Level, HNA = Highly Noise Affected (i.e. 75 dBA or greater for residential receivers).

Operational noise criteria

Under the RNP, road development is either classified as a “new road” or a “redevelopment of an existing road”. The proposal is not considered a redevelopment of an existing road or a new road as it is not intended to increase the traffic carrying capacity of the overall road or accommodate a significant increase in heavy vehicle traffic. As such the noise thresholds for residential receivers during operation of the Proposal are adopted from the criteria listed in Table 6-29.

Table 6-29: Operational noise criteria for residential receivers

Existing road category	Target Noise Level dB(A) ¹	
	Day-time (7am–10pm)	Night-time (10pm–7am)
Freeway/arterial/sub-arterial road	$L_{Aeq(15\text{hour})}$ 60	$L_{Aeq(9\text{hour})}$ 55

(1) All criteria are external, applicable at the facade of the affected residence

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

- Trigger 1: The predicted Build noise level exceeds the NCG controlling criterion and the noise level increase due to the project (i.e. 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) $_{Leq,15\text{hour}}$ during daytime periods or at least 60 dB(A) $_{Leq,15\text{hour}}$ 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 safeguards and management measures to consider in addition. 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 safeguards and management measures such as quieter pavement and noise barriers, then the receiver is eligible for consideration of at-property treatment.

6.6.3 Potential impacts

Construction Noise

Residential receivers

Construction of the Proposal would result in exceedance of NMLs at receivers in all three residential noise catchment areas located to the south and west of the Proposal. The predicted noise levels in each NCA indicate:

- Daytime NMLs are predicted to be exceeded in all residential NCAs during corridor clearing and bulk earthworks.
- During any night-time works, exceedances of NML are predicted in most residential NCAs.
- Sleep disturbance impacts are predicted for residential receivers in all NCAs where construction works are carried out in close proximity during the night-time period.

Some construction activities would be required to take place out of hours to minimise traffic disruption. These works are likely required to be undertaken in six of the seven modelled construction scenarios (excluding CA1 – construction compound site establishment). The assessment indicated that sleep disturbance for residential receivers is considered likely in all NCAs as a result of construction works being carried out close to receivers during all construction works over the night-time period. Figure 6-16 provides a summary of affected sensitive receivers based on worst case impacts from out of hours work CA5 – drainage infrastructure works.

Due to predicted exceedances of the NMLs, feasible and reasonable safeguard controls would be considered when undertaking the range of construction scenarios described and assessed in this Table 4.2 of Appendix H.

Other noise receivers

The predicted noise levels in each NCA indicate the following noise impacts at non-residential receivers:

- Commercial receivers within NCA.A02_02N and NCA.A02_02S are predicted to be affected by all assessed construction activities. The main reason for such level of noise impact is due to the very close proximity between the construction areas and these receivers (sharing a common boundary in some cases).
- The assessed active recreation area in NCA.A02_03N is predicted to be within the construction NML. The assessed active recreation area in NCA.A02_02N is predicted to be affected by five (5) of the assessed construction activities. The passive recreations areas in NCA.A02_02N are predicted to be affected during the night-time.
- The assessed educational receiver (primary school) within NCA.A02_02N is predicted to exceed the construction NML for all assessed construction activities.

Construction Traffic Noise

Additional road traffic generated on existing roads due to construction phase of the Proposal has the potential to cause adverse road noise impacts at the identified receivers. Construction traffic is likely to utilise M4 Motorway, Parramatta Road, Hill Road, Holker Street and Silverwater Road.

The additional road traffic generated by vehicles accessing the construction site has been assessed according to the RNP. As stated in the RNP application notes, the consideration of mitigation would only be required where additional traffic on existing roads creates an increase of more than 2 dB at existing sensitive receivers. This corresponds to a traffic volume increase of at least 60 per cent, provided that the mix of traffic is generally similar.

A review of construction traffic generation for the Proposal (refer to Section 3.2.10) indicates peak construction traffic estimates of 150 light vehicles and 100 heavy vehicles. Traffic noise impacts from construction traffic would result in a <1dB increase in noise (during construction peak hour) which is in compliance with the 2bd increase allowance on existing roads (refer to Table 5.6 of Appendix H). Should the haulage route be determined to utilise roads other than those identified, a review of potential noise impacts due to construction traffic would be carried out.

During times of peak demand, a larger number of heavy vehicles are likely to access the Proposal site via the existing main roads (M4 Motorway, and Parramatta Road and Hill Road). Noise management measures to reduce the potential impact of construction traffic noise have been provided in Section 6.6.4 for inclusion in the construction noise and vibration management plan.

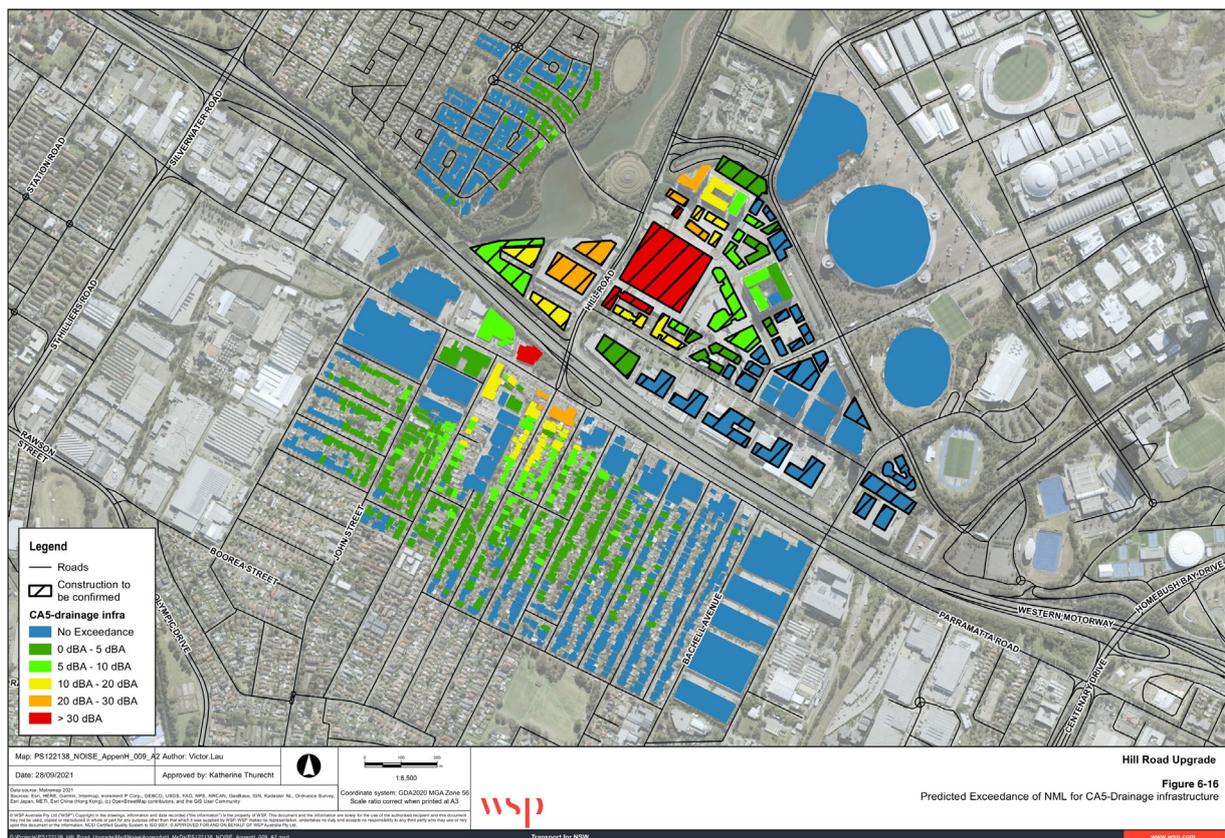


Figure 6-16: Construction noise impacts at CA5 – drainage infrastructure works

Construction vibration

Construction of the Proposal would require the use of vibration-generating equipment that may affect the range of receivers. The most significant vibration generating equipment includes Excavators, Piling Rigs and Vibratory Rollers, which are required to be used during five of the seven construction scenarios assessed (refer to Section 6.6). The Construction Noise and Vibration Strategy (CNVS) (TfNSW, 2018). CNVS provides guidelines for safe working distances for vibration-intensive activities, considering both cosmetic damage to buildings and human comfort (Refer to table 6.2 of the NVIA in Appendix H).

The nearest residential and commercial buildings would be about 10 metres and 15 metres from the limits of the construction footprint respectively. It is therefore expected that a number of the identified receivers may be affected by the proposed works (for both structural and human comfort criteria). Table 6-30 provides a summary of receivers with potential construction vibration impacts. In each case, it adopts the precautionary principle, by reporting the impact of using the largest size of equipment.

Table 6-30: Possible cosmetic building damage and human comfort amenity impacts

NCA	Offset Distances (m) ¹	Number of receivers within minimum safe working distances					
		Excavator (Hydraulic Hammer) ²		Piling rig (Vibratory) ⁵		Vibratory Roller ³ / Compactor	
		CD ⁴	HC ⁴	CD ⁴	HC ⁴	CD ⁴	HC ⁴
Residential receivers							
NCA.A01_02N	≥850	-	-	-	-	-	-
NCA.A02_01	20 – 850	2	14	-	-	-	-
NCA.A02_02N	10 – 750	5	8	-	-	5	10
NCA.A02_02S	180 – 650	-	-	-	-	-	-
NCA.A02_03N	150 – 500	-	-	-	-	-	-
Commercial properties							
NCA.A01_02N	280 – 900	-	-	-	-	-	-
NCA.A01_02S	≥650	-	-	-	-	-	-
NCA.A02_01	60	-	-	-	-	-	-
NCA.A02_02N	15 – 700	8	9	2	2	2	9
NCA.A02_02S	10 – 380	1	7	1	1	1	11
NCA.A02_03S	415 – 450	-	-	-	-	-	-
Other receivers							
NCA.A02_02N – EDU	150	-	-	-	-	-	-

- (1) Approximate horizontal distance from the nearest receiver building facade (per receiver type) to nearest construction footprints.
- (2) Assumed large hydraulic hammer (1600 kg – 18 to 34t excavator).
- (3) Assumed < 300 kN (Typically 7-13 tonnes) vibratory roller.
- (4) CD: cosmetic damage; HC: human comfort
- (5) Only active in the southern construction corridor

In summary during construction:

- Cosmetic damage may occur for up to five residential receivers and amenity impact may occur for up to ten in NCA.A02_02N (Carter Street Precinct) for residents along Hill Road, this is from the use of a large hydraulic hammer, compactor, and vibratory roller.
- Cosmetic damage may occur for up to two residential receiver and amenity impacts may occur for up to fourteen residential receivers in NCA.A02_01 (for residents along Bombay Street) from the use of a large hydraulic hammer.
- Cosmetic damage may occur for up to eight commercial receivers and amenity impacts may occur for up to nine commercial receivers in NCA.A02_02N from the use of large hydraulic hammers, a piling rig and vibratory rollers/compactors, predominantly for receivers near along Parramatta Road before Hill Road and along the southern end of Hill Road.
- Potential vibration impacts to the local heritage item may occur but would be confirmed with a pre-construction arborist survey and advise on safe working distances as well as regular surveys to monitor any impacts.

Construction noise and vibration safeguards and management measures would be required and are detailed in Section 6.6.4.

Operation

The assessment of operational noise impacts of the Proposal found:

- Six residential receivers that were predicted to exceed the NCG and NMG criteria, due to the rezoned land uses in Carter Street Precinct.
- Two non-residential receivers were predicted to potentially exceed the NCG and NMG criteria. These included future open space active and passive use within the Carter Street Precinct and a public school.
- Under a no build scenario, the predicted noise levels for 2036 indicate that without the Proposal, the spaces would already experience noise levels above the NCG criteria. It is not considered feasible and reasonable to provide mitigation for open space land use and further consideration of noise mitigation is therefore not likely to be warranted. Educational areas of the future public school are considered eligible for the consideration of mitigation.

It should be noted that although the Carter Street Precinct has received overall planning approval, many of the residential receivers identified in the Carter Street Precinct have not yet been constructed. Out of the six residential receivers expected to be impacted, only one receiver within the Precinct is constructed and eligible for mitigation measures and would need to be further consulted regarding the appropriate mitigation. The other receivers in the Precinct do not currently have an approved Development Application (DA). Mitigation would be considered if the DA is approved prior to the determination of this Proposal and consider any existing mitigation as part of the respective DA. Further assessment would determine whether additional noise mitigation is feasible and reasonable.

As such, the noise and vibration impacts assessed for receivers in the Carter Street Precinct represent a worst case scenario and the actual land use status of these properties would be confirmed before and during construction of the Proposal.

Modelling results of the operational assessment are presented in Table 9.2 of Appendix H.

Total road noise levels are predicted to not increase by more than 2dB. There are no expected noise impacts as traffic noise road impacts are minimal compared to the dominant traffic noise from the M4 Motorway. Operational road traffic was assessed using the RNP and detailed assessment criteria are in Chapter 8 of Appendix H.

Noise and vibration safeguards and management measures as described in Section 6.6.4 would apply to impacted residential receivers, as required.

6.6.4 Safeguards and management measures

Table 6-31: Noise and vibration safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise and vibration	<p>A Noise and Vibration Management Plan (NVMP) would be prepared and implemented as part of the CEMP. The NVMP would generally follow the approach in the Interim <i>Construction Noise Guideline</i> (ICNG) (DECC, 2009) and identify:</p> <ul style="list-style-type: none"> • all potential significant noise and vibration generating activities associated with the activity • feasible and reasonable mitigation measures to be implemented, taking into account <i>Beyond the Pavement: urban design policy, process and principles</i> (TfNSW, 2014) • a monitoring program to assess performance against relevant noise and vibration criteria • arrangements for consultation with affected property owners 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. 	Contractor	Detailed design / Pre-construction	Standard safeguard NV1 Section 4.6 of QA G36 <i>Environment Protection</i>
Noise and vibration	<p>All sensitive receivers likely to be affected would be notified at least seven days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification would provide details of:</p> <ul style="list-style-type: none"> • the Proposal • the construction period and construction hours • contact information for project management staff • complaint and incident reporting. 	Contractor	Detailed design / Pre-construction	Standard safeguard NV2 Section 4.6 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise	Where feasible, the use of noisy equipment such as jackhammers, vibratory rollers and profilers should be confined to standard hours or should be scheduled to be carried out early in the evening or night period.	Contractor	Construction	Additional safeguard
Noise	Provide periods of respite from the use of noise intensive plant. Respite periods should be increased during periods where the community is more sensitive to noise such as evening and night-time hours.	Contractor	Construction	Additional safeguard
Noise	Notify the community before starting any noise intensive work in accordance with the community consultation strategy.	Contractor / Transport for NSW	Construction	Additional safeguard
Noise	Orientate stationary and directional noise sources away from sensitive receivers.	Contractor	Construction	Additional safeguard
Noise	Use vehicles, obstacles and stockpiles onsite to provide shielding to receivers, especially for static noise sources.	Contractor	Construction	Additional safeguard
Noise	Use equipment that has noise levels equal to or less than the sound power levels as defined in Appendix H	Contractor	Construction	Additional safeguard
Noise and vibration road traffic	<p>Measures to reduce potential impacts from construction traffic:</p> <ul style="list-style-type: none"> • specifying designated travel routes to and from the project site to avoid local roads and roads where residential receivers are potentially impacted • restricting deliveries to standard working hours where possible • prohibiting the use of engine/compression brakes in or near residential areas • promoting driving behaviour that reduces potential noise impacts • prohibiting engine be left idling near residential receivers when not in use • strategic positioning of site accesses to minimise the chance of trucks passing by residential receivers, especially at night. 	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Sleep disturbance	<p>Measures to reduce sleep disturbance:</p> <ul style="list-style-type: none"> works outside of standard hours should be performed in accordance with the CNVG scheduled activities that are likely to cause maximum noise events such as deliveries, moving material or equipment, compacting and demolition works to avoid the night-time period (10pm to 7am) avoid dropping tools or materials from height, striking materials, dragging materials or making metal on metal contact educate workers on the importance of minimising noise and avoid creating short duration high noise level events inform surrounding residents by mail, email or SMS of planned works prior to the works commencing. 	Contractor	Construction	Additional safeguard
Vibration	<p>Measures to minimise the risk of vibration impacts:</p> <ul style="list-style-type: none"> the required locations for vibration intensive equipment would be reviewed during detailed design when more specific information is available all equipment would be maintained and operated in an efficient manner, in accordance with manufacturer's specifications, to reduce the potential for adverse vibration impacts ensure safe working distances where work is required within the nominated safe working distances objectives for human comfort, implementation of additional vibration mitigation measures would follow as outlined in Appendix H 	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Vibration	If vibration intensive equipment is to be used within the safe working distances, the following would apply: <ul style="list-style-type: none"> • lower powered equipment to be considered • attended vibration monitoring or vibration trials would be undertaken when proposed works are within the safe working distances to ensure that levels remain below the criterion as described in Appendix H. 	Contractor	Construction	Additional safeguard
Vibration	To minimise potential vibration impacts to the heritage listed item, the following would be considered: <ul style="list-style-type: none"> • pre-construction arborist survey and advise safe working distances 	Contractor	Construction	Additional safeguard
Operational noise	At-property architectural treatments would be provided to mitigate any operational noise impacts, subject to the property development timing, and application of those treatments being deemed feasible and reasonable. Treatment would be determined following an inspection of the property, and any mitigation offered would be implemented in consultation with impacted property owners.	Transport for NSW	Detailed design/ pre-construction	Additional safeguard

6.7 Aboriginal cultural heritage

This section describes the Aboriginal heritage impacts associated with the Proposal.

6.7.1 Methodology

A search for known Aboriginal heritage items in the vicinity of the study area (plus a 200 metre buffer) was undertaken on 20 April 2021 using the Aboriginal Heritage Information Management system (AHIMS) database.

6.7.2 Existing environment

Aboriginal peoples have lived in the area for the past 20,000 years. Locally there is no evidence, sensitivity or potential associated with the Proposal or Haslams Creek and its tributary due to the infrastructure development that has taken place in the area (Kelleher Nightingale, 2014).

The most common site type locally is potential archaeological deposits, however shells, art work, a scarred/carved tree, shells and other artefacts were also found in the area. The absence of Aboriginal heritage items within and local to the proposed Proposal's study area reflects the area's high level of development that has impacted on the natural landform and landscape.

Due to the European development history of the area (further discussed in Section 6.8), it is likely to have resulted in the destruction or disturbance of any Aboriginal archaeology in the area. There is likely to be nil-to-negligible potential or discovering Aboriginal archaeology locally given the extensive past ground disturbance.

The AHIMS search did not identify any known Aboriginal heritage items within or close to the Proposal.

6.7.3 Potential impacts

As no Aboriginal places, items or objects have been identified within or surrounding the study area, no construction or operation impacts on Aboriginal heritage are expected. Additionally, the high level of previous development within the study area limits the potential for any archaeological discovery. Based on these findings no further investigation is warranted.

6.7.4 Safeguards and management measures

Table 6-32: Aboriginal cultural heritage safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Aboriginal heritage	A <i>Standard Management Procedure - Unexpected Heritage Items</i> (TfNSW, 2015) would be implemented as part of the CEMP. It would provide specific guidance on measures and controls to be implemented for managing unexpected impacts on Aboriginal heritage.	Contractor	Detailed design / pre-construction	Section 4.9 of QA G36 <i>Environment Protection</i>

6.8 Non-Aboriginal heritage

A Statement of Heritage Assessment (SOHI) was prepared to assess the potential impacts of the Proposal (Artefact 2021). An assessment of impacts was undertaken to listed heritage items, as well as impacts to areas of archaeological potential. The following section is a summary of the key findings of the SOHI. The full SOHI is provided in Appendix I of this REF.

6.8.1 Methodology

The SOHI has been prepared in accordance with principles contained in the *Burra Charter of Australia International Council on Monuments and Sites (ICOMOS)*. The principles of the charter are relevant to the assessment, conservation and management of sites and relics. The assessment of heritage significance is outlined through legislation in the Heritage Act 1977 and implemented through the NSW Heritage Manual and the Archaeological Assessment Guidelines. The SOHI has been prepared using the document Statement of Heritage Impact 2002, prepared by the NSW Heritage Office, contained within the NSW Heritage Manual.

Heritage listed items were identified through a search of relevant state and federal statutory and non-statutory heritage registers:

- World Heritage List
- Commonwealth Heritage List
- National Heritage List
- State Heritage Register
- Auburn LEP 2010
- Section 170 Heritage and Conservation Registers
- NSW State Heritage Inventory (SHI) database

For the purposes of the SOHI assessment, a 100 metre buffer zone has been established around the Proposal's study area as shown in Figure 3-1. Heritage items within 100 metres of the study area are included and assessed in this SOHI.

Information from a previous site inspection undertaken on 15 March 2017 and on 3 April 2019 were referenced in this SOHI. The site inspection aimed to identify the heritage values in the study area and confirm the Proposal's impact on the listed heritage items.

6.8.2 Existing environment

Site history

The following historical overview of the study area has been prepared to provide context to the cultural significance of the study area. Refer to Appendix I for a detailed historical timeline.

Exploration to the west of Sydney Cove began soon after first settlement, as it was found that the sandstone soils of coastal Sydney were unsuited to cultivation and it was necessary to find more fertile land. On 4 February 1788, an exploring party rowing up what is now the Parramatta River reached Homebush Bay, coming close to the area known today as Lidcombe.

Later in 1788, a government farm was established on the banks of the Parramatta River at Parramatta (initially named Rose Hill). A government house was built near the farm, which prompted the development of the town of Parramatta, laid out in 1790. Between 1789 and 1791, an overland track between Parramatta and Sydney was cleared through the bush and became the basis for 'the road to Parramatta'. In 1793, the first European land grants in the vicinity of the suburbs of Homebush, Lidcombe, Auburn and Strathfield were made to a group of free settlers, and the higher and drier lands along Parramatta Road area became known as 'Liberty Plains'.

In October 1799, free settler D'Arcy Wentworth received a 140 acre grant, which became the Home Bush estate. The Home Bush estate was bounded by Homebush Bay, Powell's Creek, Haslam Creek and the Parramatta Road. Wentworth developed the estate as his country residence; clearing land, establishing a substantial house at the south eastern corner of the landholding and dividing the land into estate into fields with post and rail fences.

By the early nineteenth century, Parramatta Road was a major thoroughfare for the colony (Figure 6-17). A track leading west from Parramatta to the Nepean River was also built between 1788 and 1789. In 1815, William Cox led construction of the Great Western Road from the Nepean River through the Blue Mountains, with a ferry crossing of the river at Emu Plains. In December 1817, Cox also completed construction of the section of the Great Western Road between Emu Plains and Parramatta, which was later named the Great Western Highway in 1928.



Source: *State Library of NSW*

Figure 6-17: Parramatta Road near Lidcombe, looking west towards Auburn, 1927

On 26 September 1855, a railway link between Sydney and Parramatta was officially opened, being the first section of the NSW railway network to be completed. The arrival of the railway prompted more rapid subdivision and development in areas along its route. Between Strathfield and Parramatta, the railway line roughly followed Parramatta Road. This encouraged increased development along the corridor and in the local area.

Development in the area expanded when Lidcombe was used during the Second World War for defence training (the War Service Homes Commission) and as a site for building military aircraft. This was reinforced during the post-war period, with the area being zoned for industry (Cumberland County Plan) and housing (Housing Commission). Homebush remained an area that was predominantly used for industry.

The importance of Parramatta Road (also known as the Great Western Highway) increased in the middle of the twentieth century as more people started to own cars. This led to various widenings, upgrades, improvements and extensions. The staged construction of the M4 Western Motorway as the F4 Western Freeway between the late 1960s and mid-1980s changed the transport patterns in the area (refer to Figure 6-18). It also led to increased industrial development along the freeway corridor, which was heightened around Homebush following the closure of the State Abattoirs in 1988.

By 1988 there was an estimated nine million cubic metres of waste and contaminated soil spread over 400 hectares within the 760-hectare Homebush site, including the former State Abattoirs. Remediation work was undertaken between 1992 and 2001 to support development of the Sydney Olympic Park. This led to controlled and uncontrolled landfilling operations and gentrification of the previously industrial precinct.



Source: Historical Imagery Viewer

Figure 6-18: Aerial photograph of area in 1986, showing beginning of construction at Sydney Olympic Park

Heritage listings

There are no sites within or near the study area included on the Commonwealth Heritage List, National Heritage List, State Heritage Register and Section 170 register. There are two LEP listed heritage items listed on the Auburn LEP 2010 located within or near the study area. Table 6-33 details these heritage items and Figure 6-19 shows its location near the Proposal.

Table 6-33: Local heritage listings

Listing / Item No.	Item	Location	Significance
Auburn LEP 2010 Item No. I20	Stand of <i>Eucalyptus longifolia</i> (Shale gravel transition forest)	Corner Parramatta Road and Hill Road, Lidcombe	Local
Auburn LEP 2010 Item No. A52	Parramatta Road Milestone	South side of Parramatta Road, east of Delhi Street, Lidcombe	Local

Heritage item I20

This heritage item encompasses a stand of Shale gravel transition forest in the Sydney Basin Bioregion (*Eucalyptus longifolia*) on the northern side of Parramatta Road/Great Western Highway. Hill Road divides the heritage curtilage of the item into a western and eastern portion.

Based on previous site surveys, the remnant section to the east has been impacted from the recent construction of the westbound on ramp upgrade and no impacts on the western section. The portion of heritage item to the west of Hill Road contains most of the mature trees. This site features a pedestrian footpath that links Parramatta Road and Hill Road. The trees to the east of Hill Road covered by the heritage listing mainly include young trees that were potentially planted following the construction of the M4 Motorway. This site is isolated by the west bound on ramp and could not be accessed for inspection due to safety concerns.

Given the relatively flat topography of the area, the woodland is a landmark and a distinctive visual element in the surrounding streetscape. The stand of trees within the heritage item are visually prominent from surrounding roads including Parramatta Road, Hill Road, Bombay Street and Delhi Street and are considered a distinctive visual feature locally.

The biodiversity assessment (detailed in Appendix D) for the Proposal also identified heritage item I20 as mainly being a highly disturbed area dominated by planted native vegetation, with the remnant Shale transition gravel forest only forming a small extent of the total area. As described in Section 6.1, it did not meet the thresholds for classification under the BC Act.

Heritage item A52

Heritage item A52 is one of a group of milestones located alongside the southern side of Parramatta Road, representing the continuing importance of Parramatta Road as a turnpike or toll road and later as a main highway between Sydney, Parramatta and the west. Milestones were a simple but important piece of infrastructure providing reference points for travellers, reassuring them that the correct path was being following, in addition to indicating distance travelled or remainder of distance to travel.

The four-sided Milestone is made of precast concrete, although a number of the milestones were made from sandstone. Originally painted white, the paintwork has almost entirely faded or flaked off. The milestone features the lettering 'S11/PTTA 4', representing Sydney, 11-miles distance and Parramatta, 4-miles distance. Heritage item A52 is located about 100 metres east of the study area and not expected to have any impacts and is not further assessed in the REF.

Assessment of archaeological potential

Based on the information presented in the historical context, previous heritage assessments, and an analysis of historical aerial photographs and maps, the study area has been used for industrial purposes and activities since 1881. For the purposes of this assessment, the potential archaeology of the study area has been classified into four phases and summarised in Table 6-34 and shown in Figure 6-20.

Table 6-34: Archaeological potential

Phase	Potential remains	Significance	Potential
Phase 1 – Early land use and grants (1794 – 1833)	Footings, occupation deposits, evidence of fence lines	Local (if present)	Nil-Low
Phase 2 – Agricultural and industrial development (1833 – 1907)	Footings, occupation deposits, evidence of industrial and agricultural activities, evidence of fence lines	Local (if present)	Nil-Low
Phase 3 – State Abattoirs (1907 – c1960s)	Footings, evidence of industrial and agricultural activities, evidence of fence lines	Nil	Low-Moderate
Phase 4 – Modern development and road corridor development (c1960s – present)	Roadway materials	Nil	High



Figure 6-20: Archaeological potential near the Proposal

6.8.3 Potential impacts

Construction

There would be direct physical impacts to LEP item I20 from vegetation clearing on the southern and western edges of the LEP curtilage at the intersection of Parramatta Road and Hill Road.

A revegetation procedure including 'trees, seedlings, chippings and turf' would be implemented for the Proposal, including any areas of the LEP item I20 that may be affected. Refer to Appendix D for details on the revegetation procedure. Although no tree or root removal is expected, there is some potential for vibration impacts to the root structure. Measures to reduce vibration impacts would include engagement of an arborist and in compliance with the SOPA Guidelines for the Protection of Trees on Construction Sites.

The LEP listing is primarily concerned with approximately ten significant trees within the item's curtilage, none of which would be removed or affected as part of the Proposal. Though vegetation would be removed during construction, this is likely to be minimal and would be offset by the revegetation procedure.

The Proposal would result in a minor direct physical impact to heritage item I20.

There are no direct physical impacts to heritage item A52 as it is located about 95 metres away from the Proposal.

Potential archaeological impacts

The prevailing historic land uses of the study area have been for agricultural and industrial activities. Activities from the construction works with the potential to impact on the archaeological resource would include excavations required for the Proposal including intersections at Carter Street and John Ian Wing Parade.

The potential for significant archaeology to be located within the study area is low, therefore the proposed works are not considered to result in an archaeological impact.

Operation

During operation of the Proposal, there would be some vegetation cleared within LEP item I20 at the intersection of Parramatta Road and Hill Road which would slightly diminish the aesthetic significance of this item as a landmark.

The removal of vegetation within the curtilage of item I20 would slightly alter the setting of the existing significant trees. However, the Proposal would not remove any trees. The potential impacts to vegetation removal would be mitigated by the recommended vegetation procedure and reinstate existing vegetation. It is also noted that the item's context and setting has previously been significantly impacted by the presence of the M4 Motorway and a range of other development and infrastructure.

The Proposal would result in a minor visual impact to heritage item I20.

There are no visual impacts to heritage item A52 as it is located about 95 metres away from the Proposal and potential impacts caused by construction vibration are unlikely.

6.8.4 Safeguards and management measures

Table 6-35: Non-Aboriginal heritage safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan (NAHMP) would be prepared and implemented as part of the CEMP. It would provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage.	Contractor	Detailed design / pre-construction	Section 4.10 of QA G36 <i>Environment Protection</i>
Non-Aboriginal heritage	<i>The Standard Management Procedure - Unexpected Heritage Items</i> (TfNSW, 2015) would be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. Work would only recommence once the requirements of that Procedure have been satisfied.	Contractor	Detailed design / pre-construction	Section 4.10 of QA G36 <i>Environment Protection</i>
Non-Aboriginal heritage	Commitment to not destroying, modifying or physically affecting any heritage items outside of the study area.	Contractor	Detailed design / pre-construction	Additional safeguard
Non-Aboriginal heritage	Ensuring the Proposal's urban design considers local heritage values	Proposal design engineer	Detailed design	Additional safeguard
Non-Aboriginal heritage	Ensuring that any new ancillary facility locations avoid heritage impacts and secure the necessary approvals. The revegetation of affected areas, including within the curtilage of heritage item I20, with similar species of trees, shrubbery and seedlings.	Proposal design engineer	Detailed design / pre-construction	Additional safeguard
Non-Aboriginal heritage	Preparing management guidelines under the CEMP to protect tree roots, trunks, branches and tree crowns and to avoid working within any tree drip lines.	Contractor	Construction	Additional safeguard
Non-Aboriginal heritage	Protection of heritage item A52 if there is any future proposals to work within the curtilage of the item.	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage root impacts	Engagement of an arborist to monitor trees during works in compliance with tree protection guidelines	Contractor	Construction	Additional safeguard

6.9 Landscape character and visual impacts

A Landscape Character and Visual Impact Assessment (LCVIA) for the Proposal was prepared by Context (Context, 2021). A summary of the findings of the LCVIA are provided in the following section. The LCVIA is provided in Appendix J.

6.9.1 Methodology

The method used to undertake the LCVIA follows the *Environment impact assessment practice note: guideline for landscape character and visual impact assessment (EIA-N04)* (RMS, 2018) ('the Guideline'). The LCVIA methods for this Proposal include:

- site visits and photographic record to review the Proposal's landscape character and visual qualities
- desktop review of relevant planning policies and procedures
- analysis of the surrounding landscape including the built and natural qualities of the area
- analysis of the Proposal's landscape character
- development of urban design vision and concepts
- assessment of the potential landscape character impacts of the Proposal
- assessment of the potential visual impacts of the Proposal
- provision of mitigation measures.

Landscape character

Landscape character is the combined quality of the built, natural and cultural aspects that make up an area and provide its unique sense of place. Landscape in this context is taken to include all qualities and characteristics of a tract of land, landform, vegetation, built form and infrastructure.

For this assessment, there are four identified landscape character zones (LCZs) including Carter Street Precinct, Haslams Creek Flats, Parramatta Road Commercial Precinct and residents of north Lidcombe. Refer to Appendix J for its location relative to the Proposal. Details of each of the LCZs are further discussed in Section 6.12.2.

The method to measure impact is based on the combination of sensitivity of the existing area or view to change and magnitude of the Proposal on that area or view. Sensitivity and magnitude are defined by the Guideline as:

- Sensitivity – the qualities of an area, the number and type of receivers and how sensitive the existing character of the setting is to the proposed nature of change.
- Magnitude – the type of Proposal and its compatibility with the exiting landscape character. The scale of elements, as well as location or setting.

Visual impact assessment

The potential visual impact of the Proposal is assessed in relation to a number of key viewpoints. Locations and directions of chosen viewpoints are representative of the range of viewpoints within the visual catchment of the Proposal.

Visual sensitivity is dependent on the following:

- distance between viewer and the Proposal
- the category of viewer/receiver (resident, worker, shopper, open space user)
- the elements of the Proposal that are visible
- importance of the view, for example, identified in tourist guides, static or moving viewpoint, do people deliberately seek the view.

The magnitude of a Proposal refers to the scale, form and character of the Proposal. In the case of visual impact assessment it also incorporates how far the Proposal is from the viewer.

Figure 6-21 shows how the level of sensitivity and magnitude are combined to achieve an overall landscape character and visual impact rating.

		MAGNITUDE			
		High	Moderate	Low	Negligible
SENSITIVITY	High	High	Moderate - High	Moderate	Negligible
	Moderate	Moderate - High	Moderate	Moderate - Low	Negligible
	Low	Moderate	Moderate - Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible
		Negligible	Negligible	Negligible	Negligible

Figure 6-21: Landscape character and visual impact assessment matrix

6.9.2 Existing environment

Overview

The regional context of the Proposal is within the Sydney Metropolitan region close to areas of varying land use including residential suburbs of Strathfield, Newington, Wentworth Point, Rhodes and Sydney Olympic Park Peninsula and enterprise/light industrial in Auburn, Flemington and the area adjacent to Silverwater Road between the M4 Motorway and the Paramatta River.

Land use adjacent to the Proposal primarily consists of industrial and commercial uses with recreational amenity areas to the north which provide a significant amount of public open space and reserves providing opportunities for passive and active recreation. Refer to Figure 4-1 for an overview of the surrounding land uses to the Proposal.

Within the local area, the Sydney Olympic Park peninsula and Carter Street Precinct are planned strategic growth areas near the Proposal. The development of the area includes a range of building heights from nine metres for existing low density residential up to 72 metres for some buildings in the future Precinct.

Native vegetation has been largely cleared with only patches of small remnant vegetation along Hill Road and the eastbound M4 Motorway on ramp including a mix of planted exotic and non-indigenous species along the verges of the road. Refer to Section 6.1 for further details of vegetation near the Proposal.

Waterways in the area include Haslams Creek and its tributary, and Powells Creek, both of which drain to the Parramatta River. Refer to Section 6.2 for further details.

Landscape character zones

The four identified LCZs include Carter Street Precinct, Haslams Creek Flats, Parramatta Road Commercial Precinct and residents of north Lidcombe. Table 6-36 describes each of the LCZs and are shown in Figure 6-22.

Table 6-36: Landscape character zones description

LCZ	Description	Sensitivity
LCZ 1 – Carter Street Precinct	The Carter Street Precinct in its current condition is primarily commercial and utilitarian in nature. It is a highly modified landscape dominated by large commercial buildings with minimal planting. Future land use of the LCZ1 would alter to high density residential with the development of the Precinct. Sensitivity is expected to be high.	Low (existing) High (future)
LCZ 2 – Haslams Creek	Located north of the Proposal and includes ecological importance of wetland systems and recreational value of the adjacent woodlands.	High
LCZ 3 – Parramatta Road Commercial Zone	Directly adjacent to the Proposal along Parramatta Road and composed mostly of commercial properties.	Low
LCZ 4 – Lidcombe Residential Zone	Located further south of the Proposal beyond the Parramatta Road Commercial Zone, this area includes a residential area with low scale neighbourhood character.	High

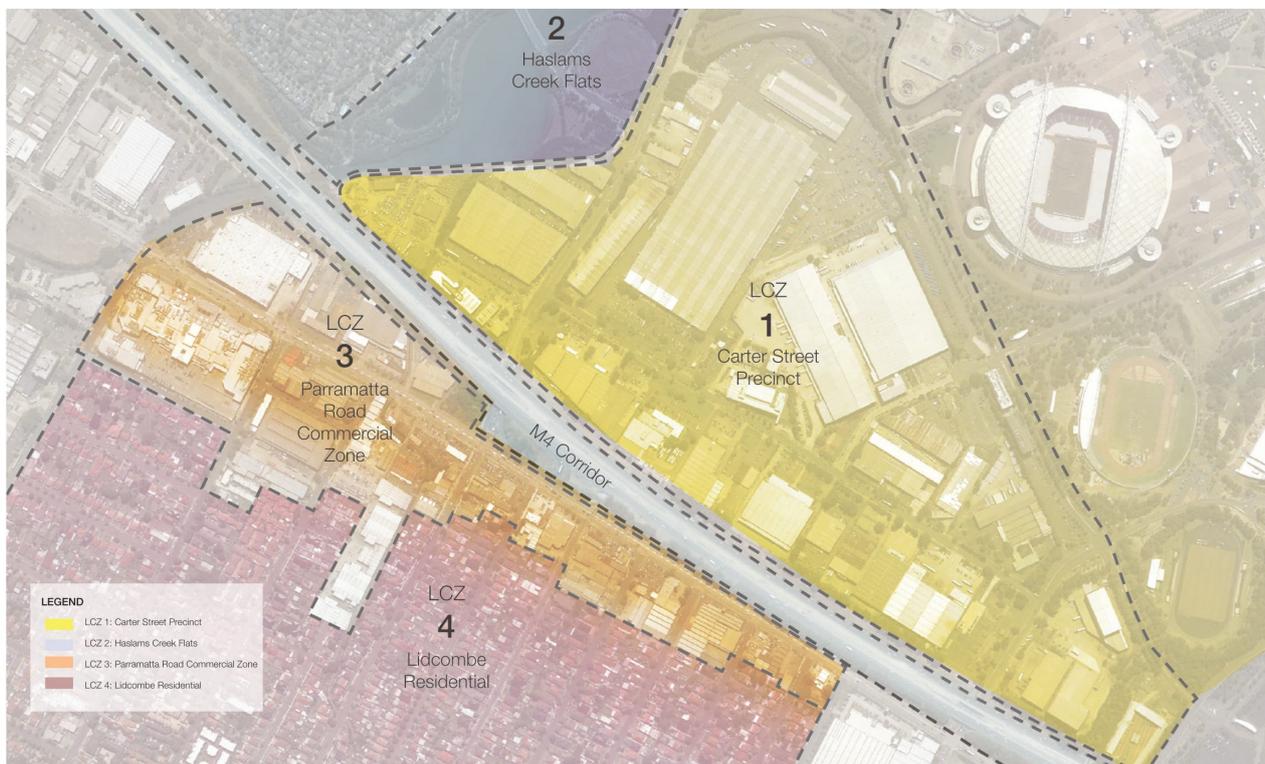


Figure 6-22: Landscape character zones of the Proposal

Viewpoints

There are 10 viewpoints selected for the assessment of this Proposal. Details of each of the viewpoints are summarised in Table 6-37 and shown in Figure 6-23.

Table 6-37: Description of the Proposal's viewpoints

Viewpoint #	Description	Visible elements and viewers	Sensitivity	Magnitude
VP 1	Haslams Creek Flats Mound	<ul style="list-style-type: none"> views of the Proposal would only be visible from the top of the mound. proximity of the water bodies and wetland system from the Proposal is of significant distance. 	Low	Low
VP 2	Hill Road southbound	<ul style="list-style-type: none"> views of the modified intersection motorists driving on Hill Road southbound pedestrians using the footpath 	Moderate	Moderate
VP 3	Hill Road southbound	<ul style="list-style-type: none"> views of the modified intersection and footpath employees near the Proposal pedestrians and cyclists 	Low (employees) High (ped/cyclists)	Low (employees) High (ped/cyclists)
VP 4	Hill Road northbound	<ul style="list-style-type: none"> views of the modified Hill Road employees near the Proposal 	Moderate	Negligible
VP 5	Hill Road / Ian Wing Parade northbound	<ul style="list-style-type: none"> views of the modified intersection motorists driving on Hill Road pedestrians using the footpath 	High	Moderate
VP 6	Hill Road / Ian Wing Parade eastbound	<ul style="list-style-type: none"> views of the modified intersection motorists driving on Hill Road pedestrians using the footpath 	High	Moderate
VP 7	M4 Hill Road exit	<ul style="list-style-type: none"> views of the modified M4 Motorway Hill Road on ramp motorists entering the on ramp 	Low	Low
VP 8	Bombay Street / Parramatta Road intersection	<ul style="list-style-type: none"> views of the modified intersection motorists driving along Bombay Street and Parramatta Road customers from the car sale yard 	Low	High
VP 9	Parramatta Road eastbound	<ul style="list-style-type: none"> views of the modified road motorists driving along Parramatta Road 	Low	High
VP 10	Birnie Avenue / Parramatta Road intersection	<ul style="list-style-type: none"> views of the modified pedestrian crossing and kerb adjustment motorists driving near Birnie Avenue and Parramatta Road pedestrians using the footpath 	Low	Low



Figure 6-23: Viewpoints of the Proposal

6.9.3 Potential impacts

Construction

Construction of the Proposal would result in a temporary change to the landscape character and visual amenity as a result of the establishment of a construction site (including ancillary facilities).

The Proposal would have the greatest impact on the values associated with established and new residential areas and users of Hill Road within LCZ 1 and LCZ 4. Impacts would be:

- loss of the composition of the landscape character and its setting
- removal of small amounts of vegetation
- temporary introduction of machinery, stockpiles and stored materials and equipment into the landscape, affecting the overall amenity and setting.

The main receivers from construction impacts would be those overlooking the Proposal, including, construction compounds and ancillary facilities located on the east side of Hill Road near the proposed Stockyard Boulevard intersection.

It is expected that the greatest amenity impacts would take place during the major earthworks along Hill Road. Once construction work is complete along the Proposal, the impacted areas would be reinstated and landscaped.

Mitigation measures have been identified for temporary construction works to manage visual impacts and are discussed in Section 6.10.4.

Operation

The Proposal would generally align with the urban landscape and context of the area; however, the Proposal's context would differ compared to existing conditions due to property acquisition and new development. The Proposal would require a permanent partial land acquisition of 0.5 hectares which are further detailed in Section 6.10.3. In addition, the Carter Street Precinct would alter the existing land use to high density residential on the east side of Hill Road.

Key LCZ impacts ranging moderate to high during operation of the Proposal are:

- LCZ 1 = the area would include new land use of the Carter Street Precinct and the Proposal would affect the quality of the surrounding open space and residential uses
- LCZ 3 = the Proposal would introduce a more dominant feature and alter the landscape due to road widening along Hill Road and Parramatta Road.

Overall, the Proposal would result in low and moderate visual impacts as summarised in Table 6-38. The viewpoints with noted low visual impact levels reflects the low visibility of the Proposal, consistency with the existing road environment and the users' indifference to the proposed changes.

Moderate visual impacts are identified for six viewpoints throughout the Proposal. The main impacts of the Proposal during operation are:

- modification of the road including lane widening, turn lanes and intersection
- introduction of a new shared user path.

Table 6-38: Summary of viewpoint impacts

Viewpoint #	Description	Impact level
VP 1	Haslams Creek Flats Mound	Low
VP 2	Hill Road southbound	Moderate
VP 3	Hill Road southbound	Moderate
VP 4	Hill Road northbound	Low
VP 5	Hill Road / Ian Wing Parade northbound	Moderate
VP 6	Hill Road / Ian Wing Parade eastbound	Moderate
VP 7	M4 Hill Road exit	Low
VP 8	Bombay Street / Parramatta Road intersection	Moderate
VP 9	Parramatta Road eastbound	Moderate
VP 10	Birnie Avenue / Parramatta Road intersection	Low

The removed vegetation as noted in Section 6.1 would be retained where possible and would be replanted. Section 6.9.4 identifies a series of landscape and urban design mitigation strategies to minimise landscape and visual impacts from the Proposal.

6.9.4 Safeguards and management measures

Table 6-39: Landscape character and visual impacts safeguards and management measures

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 (refer to Section 6.1 for further details) built elements including retaining walls, bridges and noise walls pedestrian and cyclist elements including footpath location, paving types and pedestrian crossings 	Contractor	Detailed design / pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> • 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. The Urban Design Plan will be prepared in accordance with relevant guidelines, including: • Beyond the Pavement urban design policy, process and principles (Transport for NSW, 2014) • Landscape Guideline (RTA, 2008) • <i>Bridge Aesthetics</i> (Transport for NSW 2012) • Noise Wall Design Guidelines (RTA, 2006) • Shotcrete Design Guideline (RTA, 2005). 			
Landscape character and visual impact	<p>A detailed landscape plan would be prepared for the Proposal and incorporate the Urban Design, Landscape Character and Visual Working Paper and include detailed set out, species and planting guides. Where areas of habitat are to be re-established, this will occur consistent with Guide 3 Re-establishment of Native Vegetation of the Roads and Maritime Biodiversity Guidelines (RTA 2011b).</p>	Contractor	Detailed design	Additional
Landscape character and visual impact	<p>Where practicable, the height of retaining walls would be minimised allowing introduction of a batter and construction of reinforced soil wall to allow reinstatement of planting along verges.</p>	Contractor	Detailed design	Additional

Impact	Environmental safeguards	Responsibility	Timing	Reference
Landscape character and visual impact	<p>For minimising view of construction site compounds and related facilities:</p> <ul style="list-style-type: none"> careful planning and positioning of temporary offices, other plant and material laydown areas, specific management of lighting and potential for light spill within the identified construction site compounds vegetation, mature or otherwise, currently located between construction site compounds and adjacent residential areas will be retained where practicable to screen views. 	Contractor	Construction	Additional

6.10 Socio-economic

A socio-economic impact assessment (SEIA) was prepared to assess the potential socio-economic impacts of the Proposal (WSP, 2021d). The assessment considered the community, business and industry impacts of the construction and operational stages of the Proposal. The SEIA technical paper is provided in Appendix K.

6.10.1 Methodology

The assessment has been prepared in accordance with the *Environmental Impact Assessment Practice Note: Socioeconomic Assessment* (EIA-N05, Roads and Maritime Services, 2013). Along with the EIA-N05, it also follows and adopts several wider guidelines including:

- *Interorganisational Committee on Guidelines and Principles (1994). Guidelines and principles for social impact assessment.* US. Dep. Commer., NOAA Tech. Memo. NMFSF/SPO-16, 29 pp.
- *Mackenzie Valley Environmental Impact Review Board (2007), Socio-Economic Impact Assessment Guidelines*
- New South Wales Social Policy Development Unit, The Cabinet Office (1997) “*Guidelines for Assessing Social Impacts*”, *New South Wales Government*.

Key steps in the assessment process included:

- Scoping potential socioeconomic issues and identifying the communities and groups most likely to be affected.
- Determining an appropriate study area to assess socioeconomic impacts and benefits.
- Describing the existing socioeconomic environment across the study area to provide a baseline from which the impacts of the Proposal were assessed. This involved:
 - reviewing existing State and local Government strategies relevant to the social and economic environment of the study area
 - analysing key population and demographic indicators, including ABS 2016 Census data on population and housing
 - analysing data and information on local business and industry, employment and income, and dwelling characteristics

- reviewing existing social infrastructure and community features near to the Proposal, including recreation and amenity uses, schools, churches, public transport and walking and cycling facilities
- confirming what the local and regional community values are through review of local consultation reports.
- Identifying and assessing the Proposals potential socioeconomic impacts considering:
 - property impacts
 - amenity impacts
 - direct and indirect social and community infrastructure impacts
 - local business and industry impacts
 - local access and connectivity impacts and their effects on motorists, pedestrians, cyclists and other road users.
- Identifying where the existing mitigation measures and conditions of approval need modifying or supplementing because of the Proposal.

The information used in the SEIA was drawn from the following key data sources:

- Population and demographic data from the ABS 2016 Census.
- Population and demographic socioeconomic data relating to the study area from local councils or State government.
- State and local Government policies and strategies relevant to the study area including:
 - Carter Street Precinct Master Plan
 - Carter Street Priority Precinct development control plan (DCP)
 - Carter Street Lidcombe Priority Precinct finalisation report
 - Sydney Olympic Park Authority master plan
 - Local environmental plans (LEPs) and DCPs
 - Community, agency and stakeholder feedback obtained to support this Proposal (as described in Chapter 6 of the upgrade report).
- Other technical working papers including:
 - traffic, transport and access assessment (Appendix G)
 - noise and vibration impact assessment (Appendix H)
 - landscape character and visual impact assessment (Appendix J).

Study area

For purposes of this SEIA, the assessment study area includes the following 2016 Australian Bureau of Statistics (ABS) level 2 statistical areas (SA2):

- Auburn – Central (125011582)
- Auburn – North (125011583)
- Homebush Bay–Silverwater (12011473)
- Lidcombe (125011586)
- Homebush (120031396).

The study area has been defined to include those communities that have the greatest potential to experience socioeconomic change because of the Proposal. These changes can either be because of the location of the work or construction activity, or changes to the local movement patterns of residents, workers or visitors. Figure 6-24 shows the socio-economic study area.

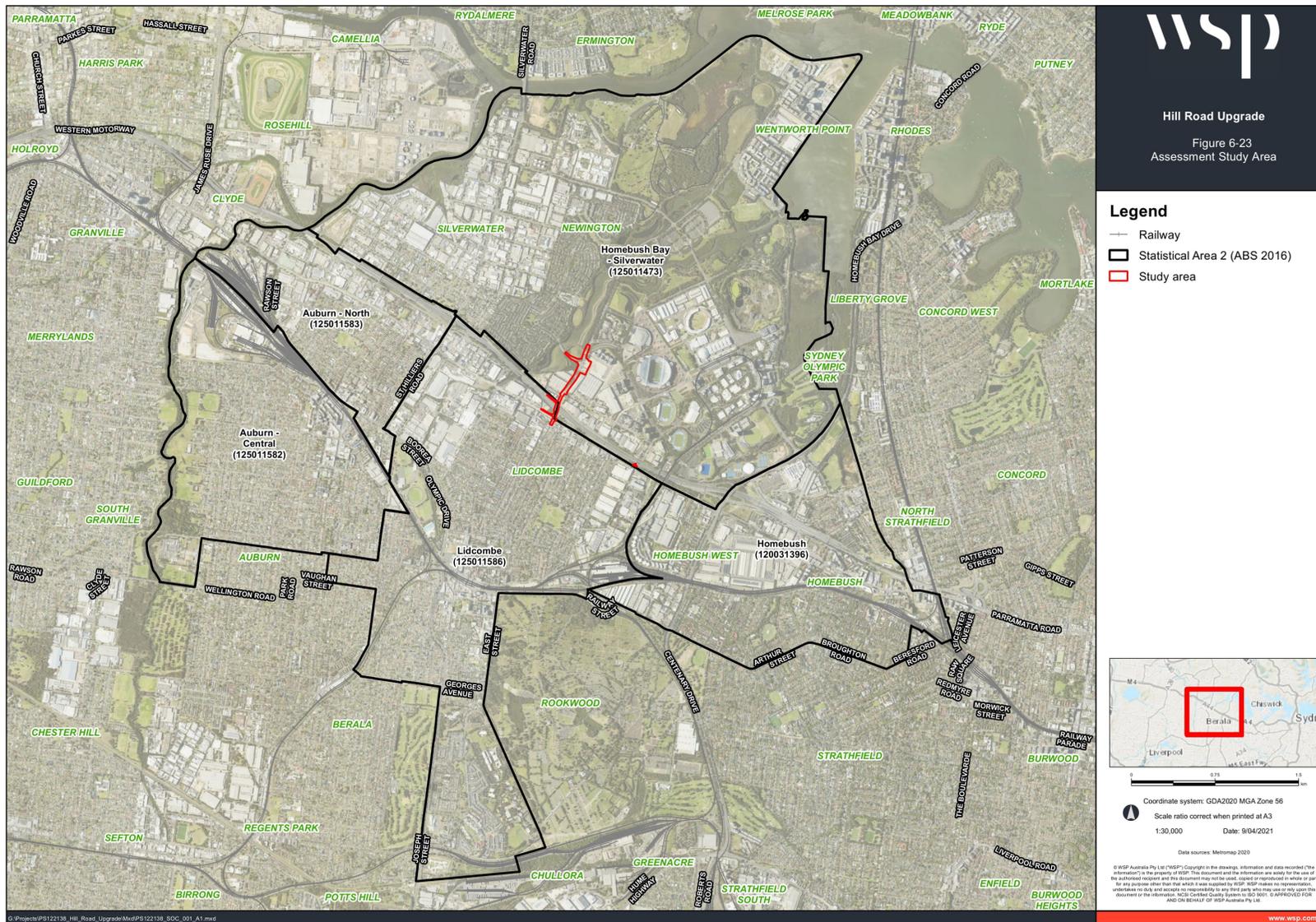


Figure 6-24: Socio-economic study area

6.10.2 Existing environment

The Proposal is located within the Cumberland and City of Parramatta councils. Based on data from the 2016 ABS, an overview of social and economic demographics includes:

- an estimated resident population of 83,429 at a density of 2,807.4 persons per square kilometre
- culturally diverse with 69.5% per cent of population born overseas, compared to 42.9 per cent across Greater Sydney
- the top four non-English speaking countries of birth for the resident population included China, India, South Korea and Nepal
- slightly younger resident population, which is an age group that is likely more adaptable to change
- higher proportion of group households and a lower proportion of lone person households
- 15,934 families of which the majority lived within the areas of Homebush Bay–Silverwater and Lidcombe
- significantly higher proportion of flats, units and apartments, with this housing type more than triple the NSW average in Auburn – Central, Auburn – North, Homebush Bay–Silverwater and Homebush
- greater proportion of rental dwelling and higher median weekly rents (\$458) than Greater Sydney (\$440)
- most people that do travel to work do so by car followed by people travelling to work by public transport
- lower median weekly household incomes (\$1,606) compared to Greater Sydney (\$1,750), and higher unemployment (6.3%) compared to Greater Sydney (6%).

Detailed findings and data are within Appendix K.

6.10.3 Potential impacts

Construction

Acquisition of property and changes to land use

The Proposal would acquire 0.5 hectares of land for widening of Hill Road and to accommodate the construction compound and ancillary facilities as described in Section 3.5 and shown in Figure 3-7.

It should be noted that Lot 302/DP541070 would be a full acquisition (8,357 square metres) for the construction compound. However, at the completion of the Proposal, 3,757 square metres would be returned to City of Parramatta Council. There are also no residential properties or social infrastructure required for property acquisition.

The following are identified potential impacts from the acquisition of property during construction:

- no loss of the area's core amenity and aesthetic value from the removal of the ecological community and heritage listed item located south of the M4 Motorway
- community access through the woodland would still be maintained
- some associated frustrations from increased travel time and access delays
- expected levels of anxiety and stress related to property acquisition are unlikely as businesses and their employees have been made aware of the Proposal through ongoing consultation
- businesses in the area do not typically rely on passing trade and business operations would not be impacted as access along Hill Road would be maintained.

While the final acquisition would be confirmed during the detailed design, it would be carried out in accordance with *Land Acquisition (Just Terms Compensation) Act 1991*, accounting for the NSW Government Land Acquisition Reform 2016, or the *Roads Act 1993* as supported by the Land Acquisition Guide (Transport for NSW, 2012). These provisions would ensure that the acquisition would be undertaken 'equitably' and without any impact on the commercial properties or owner's statutory rights.

Land use is expected to have negligible impacts as the Proposal impacts would be temporary and consistent with the existing land use in the area. Refer to Section 6.9 for further details.

Business, employment and economy

Construction of the Proposal would include a peak workforce of 125 people and is assumed they would travel to and from site each day. Although travel and accommodation businesses in the area are unlikely to benefit from the increased workforce, there would be some worker spending for small food, beverage and retail stores locally.

The commercial businesses currently located at Lot 302/DP541070 and Lot 301/DP541070 would be vacated prior to the construction of the Proposal to support the future Carter Street Precinct. There would be no associated revenue, job or employee income loss due to the Proposal.

In addition, the Proposal is unlikely to have any material economic impact on the adjacent commercial businesses as they are expected to continue to operate and function during construction of the Proposal. The following are potential economic benefits from the Proposal:

- benefit to the local and regional economy through the purchase of labour and material from the transportation, logistics, manufacturing, processing, construction and specialist service industries
- opportunity for the direct employment of up to 125 people to build the Proposal, and wider indirect employment from professions such as engineers, drivers and suppliers. People would be most likely employed locally, however certain specialists from across the State may also be used.

Traffic, transport and access

Construction of the Proposal is expected to have increased congestion and travel delays (for private vehicle and public transport users) on the local road network, extending beyond Hill Road and its connecting roads, as people would likely choose to enter and leave the Sydney Olympic Park via alternative routes.

These impacts would generally be managed through traffic management controls including but not limited to:

- provide a safe environment for the construction workers, road users and businesses in the area
- allow access to all properties along Hill Road/Parramatta Road
- minimise traffic delay impacts during peak periods and while major events are being held at the Sydney Olympic Park
- stage the work so that Hill Road and Parramatta Road would remain operational
- allow for emergency vehicle access at all times.

The Proposal would maintain property access for the duration of the proposed construction work, other than very occasional closures lasting a few hours outside of peak/high use periods to receive deliveries/lifting equipment.

There would likely be some inconvenience to any business that operates at night and/or over the weekend when such closures would take place. This may also have some limited impact on delivery schedules, however through ongoing consultation and management, any impacts would be limited to a short delay.

In addition, access restrictions to the footpath along the western side of Hill Road would be temporarily closed and require a footpath diversion. Pedestrians would experience a minor inconvenience from the diversion and potentially some increase in travel time.

Refer to Section 6.5 for further details on traffic, transport and access.

Social amenity and infrastructure

Construction of the Proposal would impact social amenity and infrastructure of the area due to the following:

- construction noise and vibration at levels that would affect:
 - adjacent workers in the commercial buildings and residents within proximity of the Proposal when certain work takes place during the day and at night
 - users and visitors of Sydney Olympic Park.
- loss of views and amenity from the sight of construction work and equipment
- potential dust dispersion because of the earthworks and possibly a loss local air quality through the increased use of equipment and machinery, and the effects of idling traffic in the area.

It is noted that impacts would occur mostly in dense urban areas, where the existing environment generally includes heavy traffic movements on the M4 Motorway and a range of commercial and industrial activities. As such, it is considered that additional impacts as a result of construction of the Proposal would mostly be experienced by people who routinely travel along the M4 Motorway, Parramatta Road and Hill Road or work in the commercial businesses next to the Proposal. The works would also be largely contained within the road corridor as well as have opportunities to screen construction works.

The Proposal's social infrastructure impacts would not significantly affect elements valued by the local community. The communities may experience some frustration as a result of travel delays or inconvenience caused by disruptions or changed traffic conditions which would be greatest and affect a wider section of society when a major event takes place at the Sydney Olympic Park.

Operation

Property and business

The Proposal would have a loss of 0.5 hectares of land for the operation of the Proposal. However, 3,757 square metres would be returned to City of Parramatta Council for future development.

There would be a partial acquisition of 85m² of a commercial property at the corner of Parramatta Road and Bombay Street. No impacts are expected as the Proposal would provide improved access to the business and not impact business operations.

Traffic, transport and access

The Proposal would generally improve the traffic performance in the local area. The following are identified benefits from the Proposal:

- improved access into the western and northern sections of the Sydney Olympic Park, Newington and Carter Street benefitting people who work in the east, use the business services in the area and the wider demographic of people that use the facilities at the Sydney Olympic Park
- alternative and healthy travel choices for people through the introduction of cycling facilities (in the form of a new shared user path) for the local and the wider demographic of people wanting to have an accessible off-road cycle route south of the Sydney Olympic Park
- bus priority improvements into and out of the western and northern section of the Sydney Olympic Park along Hill Road.

There would be access restrictions from the Proposal which have the following impacts:

- limited access at Carter Street intersection would be changed to left in/left out only
- motorists would need to use the John Ian Wing Parade intersection once this connection is completed within the Carter Street Priority Precinct to access the precinct
- permanent bus route modifications for bus route 401
- motorists trying to access businesses in the Carter Street Priority Precinct would need to use Old Hill Road.
- minor loss of five on street parking in Bombay Street south of Parramatta Road.

Access impacts would be the minor inconvenience experienced by employees, customers and delivery vehicles.

Social amenity and infrastructure

The urban design objectives and landscape strategy for the Proposal include landscape planting along the road margins to improve the amenity for pedestrians and cyclists in the form of a SUP.

While the native vegetation is both of ecological and heritage value, it holds limited community function or use other than the provision of shade for footpath access from Hill Road to Parramatta Road, which would be retained under the Proposal.

It is anticipated the overall impact would be moderate-low.

As the Proposal is expected to provide access improvements to the Carter Street Precinct and Sydney Olympic Park peninsula, the Proposal would have a benefit to social infrastructure in the area. The Proposal is also expected to support the urban renewal of the area and is therefore expected to lend indirect support to the planned improvements in the area's social infrastructure and community values.

The Proposal would deliver community value benefits at the local and regional level by the following improvements:

- access to the existing facilities across the Sydney Olympic Park supplemented by future improved access to the proposed community facilities built in the strategic growth areas
- transport, connectivity and access into the local area, which would advantage the high commuting population, while also potentially improving the area's liveability and usability
- access to the facilities across the Sydney Olympic Park for locals and the wider community, including improved walking and cycling infrastructure and connectivity

- road safety by building and designing the road to current standards which would be valued be mainly valued by families with young children, road users (commuters), and cyclists, notwithstanding the perceived issues discussed below.

6.10.4 Safeguards and management measures

Table 6-40: Socio-economic safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Socio-economic	<p>A Communication Plan would be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The plan would 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 plan would be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008).</p>	Contractor / Transport for NSW	Pre-construction, Construction	SE1 QA G36 <i>Environment Protection</i>
Socio-economic	Early and on-going communication and consultation would occur with property owners, business owners and residents about the property acquisition process.	Transport for NSW	Pre-construction	Additional safeguard
Socio-economic	All property acquisition will be carried out in accordance with the <i>Land Acquisition Information Guide</i> (TfNSW, 2012) and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i>	Transport for NSW	Pre-construction	Additional safeguard
Socio-economic	On-going communication and consultation with the owners of the impacted businesses would occur. This would include working with the business owners to manage and plan project construction activities and delivery to minimise impacts on their business operations.	Transport for NSW	Pre-construction	Additional safeguard
Socio-economic	Ensure that works consider other active or planned construction projects in the area and that traffic and construction impact management approaches align to reduce cumulative impacts where possible.	Transport for NSW	Pre-construction, Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Consultation with Council and relevant authorities may assist in early identification and mitigation.			

6.11 Air quality

6.11.1 Existing environment

Climate and meteorology

The nearest weather station with long-term historical records operated by the Bureau of Meteorology (BoM) is the Sydney Olympic Park automatic weather station (Archery Centre), #66212. This station is located about two kilometres northwest of the Proposal.

Data from Sydney Olympic Park automatic weather station automatic weather station indicated in 2020 that the locality around the Proposal experienced mean daily maximum temperatures of around 25 degrees Celsius. The driest period of the year was April with an average monthly rainfall of around 15.8 millimetres. It is during periods of dry, higher temperature conditions that the potential for dust generation is greatest.

Background air quality

The nearest air quality monitoring station in relation to the Proposal which monitors the pollutants of interested associated with the construction and operational phases of the Proposal is located at Lidcombe (about two kilometres southeast).

Data from the Lidcombe air quality monitoring station indicated that ambient concentrations are generally rated as 'good' air quality (BoM, 2021). This is typical with other observations from the NSW ambient air quality monitoring network throughout Sydney and underlines the importance of managing the generation of dust including fine particulate matter during the Proposal.

6.11.2 Potential impacts

Construction

To evaluate the potential for air quality impact during construction a risk-based qualitative assessment method was applied. The likelihood (probability) and consequence (severity) of activities with the potential to result in air quality impact were evaluated to develop initial risk ratings. This was completed using metrics developed based on guidance from AS/NZS ISO 31000: 2009 Risk Management – Principles and Guidelines.

Construction activities have the potential to increase airborne particulate matter and cause nuisance impact where construction is in proximity to sensitive receivers such as residential dwellings and community areas. The potential impact could include:

- temporary increased windborne dust emanating from disturbed/exposed surfaces from clearing and grubbing
- dust generation due to the disturbance, movement, storage, loading, transfer and transportation of soil for embankments and fill areas
- temporary increase in air emissions from dust and products of combustion (from equipment operations).

Construction activities would be temporary in nature but still have the potential to impact on nearby receivers. Environmental management measures have been recommended including appropriate work practices and scheduling, equipment selection, monitoring and preventative controls and as such, the risk of potential air quality impact from construction has been identified as low to moderate.

Operation

The potential impact to air quality during the operational phase of the Proposal is generally associated with motor vehicle emissions arising from changes in the volumes of motor vehicles, model of travel, such as free flow of congested and proximity to sensitive receptors. Key pollutants associated with exhaust fumes include carbon monoxide (CO) and nitrogen dioxide (NO₂).

Overall impacts to air quality during the operation of the Proposal are considered minor due to some land use change in the area. Impacts to the nearest sensitive receiver location are likely negligible and are not expected to result in any additional local exceedances. The Proposal in the long-term would also support alternative transport (e.g. active and public transport) in and around the area.

6.11.3 Safeguards and management measures

Table 6-41: Air quality safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Air quality	<p>An Air Quality Management Plan (AQMP) would be prepared and implemented as part of the CEMP.</p> <p>The AQMP would 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 • compliance with Stockpile Site Management Guidelines (Roads and Maritime, 2015) • methods to manage work during strong winds or other adverse weather conditions • a progressive rehabilitation strategy for exposed surfaces 	Contractor	Detailed design	Standard safeguard AQ1 Section 4.4 of QA G36 <i>Environment Protection</i>

6.12 Waste and resources management

6.12.1 Methodology

The two main policies that outline the requirements for waste and resources management are:

- *Protection of the Environment Operations Act 1997* (POEO Act)
- *Waste Avoidance and Resource Recovery Act 2001* (WARR Act).

The POEO Act covers the requirements for waste generators in terms of storage and correct disposal of waste and their responsibility for the correct management of waste and these have been considered in the assessment of waste generated by the Proposal, including the development of environmental management measures.

The WARR Act promotes waste avoidance and resource recovery by developing waste avoidance and resource recovery strategies and programs. Transport for NSW endeavours to manage waste in order to conserve resources and reduce the impact associated with waste disposal. The waste management hierarchy is a guide for prioritising waste management practices to achieve these outcomes. This hierarchy was established under the WARR Act. It sets out the preferred order of waste management practices from the most preferred to least preferred as follows:

- **Waste Avoidance** – Take action to avoid the generation of waste and to be more efficient in its use of resources. If unable to avoid generating waste, then reduce the amount of waste generated and reduce the toxicity or potential harm associated with its generation and management.
- **Resource Recovery** – Maximise the reuse, reprocessing, recycling and recovery of energy from materials.
- **Disposal** – Disposal is the least desirable option and must be carefully handled to minimise negative environmental outcomes.

In addition to managing waste in accordance with the relevant legislation, Transport for NSW manages waste according to the *NSW Waste Avoidance and Resources Recovery Strategy 2014-21* (EPA, 2015) and the *NSW Waste Classification Guidelines* (EPA, 2014).

6.12.2 Potential impacts

Construction

Waste generated during construction would primarily be from work associated with site preparation, relocation of utilities, and construction of road infrastructure and landscaping. Major waste-generating activities would include construction of temporary construction ancillary facilities, earthworks, placement of pavement layers, drainage, concrete pour, utilities placement and protection, installation of road furniture.

Waste streams are likely to include the following:

- surplus spoil (excavated soil, sediment, rock) from bulk earthworks or left-over imported fill which is unable to be reused within backfilling or restoration
- concrete, pavement, steel, and other materials from demolition of kerbs, fencing, pavements
- packaging materials from items delivered to site, such as pallets, crates, cartons, plastics, and wrapping materials
- general office waste generated by onsite personnel, such as paper, cardboard, beverage containers, and food wastes sewage waste generated through the use of personnel facilities.

The inappropriate handling or disposal of waste could result in a potential impact to the local environment, including soils, waterways and fauna. Given that all waste would be managed in accordance with Transport for NSW guidelines and disposed of by a licensed contractor to an appropriately licensed facility, the potential for a significant impact related to waste management is considered unlikely.

Fill would be required for the Proposal, such as for construction of embankments. Imported fill would either be virgin excavated natural material (VENM) or would comply with the conditions for reuse attached to a relevant resource recovery exemption.

Surplus or unsuitable material that cannot be used on-site would be classified in accordance with the Waste Classification Guidelines (EPA, 2014) and disposed of at an approved materials recycling or waste disposal facility.

The road pavement materials would be sourced from appropriately licensed facilities such as quarries. The demand for resources would be separated into the various stages of construction work. The amount of water that would be required during construction is unknown at this stage. The amount would depend on material sources and methodologies applied by the contractor. It is proposed that water would be obtained from the local water supply network.

Operation

Waste generated by the operation of the Proposal would be limited. The main waste streams would include any oils, liquids and chemicals used for maintenance of plant and equipment used in road maintenance activities and general litter along the road corridor.

Operational waste, including general litter clean up, would be managed in accordance with existing operational maintenance requirements for the Proposal and the impact is expected to be minimal.

6.12.3 Safeguards and management measures

Table 6-42: Waste and resources management safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Waste	<p>A Waste Management Plan (WMP) would be prepared and implemented as part of the CEMP. The WMP would include but not be limited to:</p> <ul style="list-style-type: none"> • measures to avoid and minimise waste associated with the Proposal • 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. 	Contractor	Pre-construction	Standard safeguard WR1 Section 4.2 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	The WMP would be prepared taking into account the Environmental Procedure - Management of Wastes on Roads and Maritime Services Land (RMS, 2014) and relevant Transport for NSW Waste Fact Sheets.			
Waste	Waste material would not be left on site once the work has been completed	Contractor	Construction	Standard safeguard WR2 Section 4.2 of QA G36 <i>Environment Protection</i>
Waste	All wastes, including contaminated wastes, would be identified and classified in accordance with Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes. Disposal of any non-recyclable waste will be in accordance with the POEO Act and Waste Classification Guidelines: Part 1 Classifying Waste.	Contractor	Construction	Additional safeguard

6.13 Greenhouse gas and climate change

6.13.1 Existing environment

Greenhouse gases include carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, hydrofluorocarbons and perfluorocarbons. These gases absorb heat that is reflected from the earth, which results in warming of the air. This effect is known as the greenhouse effect. The primary human produced greenhouse gas is carbon dioxide.

Human activities such as the combustion of carbon-based fuels increase the amount of greenhouse gases in the atmosphere. This leads to an increase in atmospheric temperatures and is known as the enhanced greenhouse effect.

Climate change projections detailed in this assessment have utilised publicly available information. Table 6-43 provides information on climate change forecasts for the Sydney Metropolitan and Sydney/Central Coast regions of NSW. The table provides details of the climatic change projections for the area surrounding the Proposal to the year 2070, adapted from the NSW Climate Impact Profile (DECCW 2010) and the Metropolitan Sydney Climate Change Snapshot (OEH 2014).

Table 6-43: Climate change forecasts

Season	Seasonal rainfall (% increase)	Temperature	
		Minimum (Celsius)	Maximum (Celsius)
Spring	10 – 20	2.0 – 3.0	2.0 – 3.0
Summer	20 – 50	1.5 – 3.0	1.5 – 2.0
Autumn	No significant change	1.5 – 3.0	1.5 – 3.0
Winter	10 – 20	1.5 – 3.0	2.0 – 3.0

Source: Adapted from the results for 'far future' (2060-2075) climate change in the Metropolitan Sydney Climate Change Snapshot (OEH 2014) and the NSW Climate Impact Profile (DECCW 2010)

Expected regional climatic changes for the Sydney/ Central Coast region of NSW as defined in Department of Environment, Climate Change and Water (DECCW 2010) are as follows:

- increase in average daily minimum and maximum temperatures
- shifts in current patterns of climate variability, including increased rainfall in summer and decreased rainfall in winter
- increased intensity of extreme events such as droughts, floods, severe storm events
- changes in seasonality and amount of precipitation (the direction and magnitude of changes will vary between geographic locations).

By 2070, the Sydney Metropolitan region of NSW is expected to experience a hotter climate, with temperatures projected to increase by between 1.25°C to 3°C throughout the year. Rainfall is projected to increase in spring, summer and autumn, and a decrease in winter.

6.13.2 Potential impacts

Construction

Greenhouse gas emissions

Construction of the Proposal is anticipated to be completed within about 18 months. During this time, greenhouse gas emissions would be produced, including:

- carbon dioxide, methane and nitrous oxide generated from liquid fuel use in plant and vehicles such as diesel and petrol
- embedded emissions associated with the manufacture and delivery of construction materials
- methane generated from land filling any carbon-based waste.

The volume of greenhouse gas emissions that would be generated during the construction of the Proposal would be dependent on the quantity of construction materials used and the types of plant and equipment used during building the Proposal.

Given the nature of the Proposal, it would not be possible to completely avoid the generation of greenhouse gas emissions during construction (due to the need to consume energy and resources). The volume of greenhouse emissions produced as a result of the Proposal would be minimised through the application of standard mitigation measures, as outlined in Section 6.13.3. Overall, construction related greenhouse gas emissions associated with the Proposal would be relatively minor and comparable with similar road upgrade projects.

Climate change risks

Climate change risks during the construction of the Proposal would primarily be associated with the occurrence of severe weather events; for example, the increased frequency and severity of rainfall events placing increased pressure on erosion and sediment control measures and/or flooding of the work site.

During construction, climate change risks are generally considered to be minor and would be readily manageable through the application of standard mitigation measures that have been adequately designed to respond to the potential occurrence of the increased frequency and severity of rainfall events.

Operation

Greenhouse gas emission

Greenhouse gas emissions during the operation of the Proposal would primarily be associated the operation of private motor vehicles on the road network and during road maintenance activities. The volume of greenhouse gas emissions generated during operation of the Proposal would depend on the frequency and intensity of maintenance activities and the volume of vehicles using the road network.

Emissions are anticipated to be comparable with those emissions already occurring within the area and would not be expected to significantly change because of the Proposal. Traffic volumes and/or maintenance frequencies would not be anticipated to change as a direct result of the Proposal.

Climate change risks

Climate change risks during the operation of the Proposal would primarily be associated with:

- increases in average temperatures and heatwaves which may affect the integrity of pavement and other construction materials
- direct impacts could include more rapid deterioration of infrastructure, which may result in higher operational and maintenance costs
- indirect impacts like evaporative changes can result in changes to soil moisture content and soil instability, which may impact foundations of structures, cause cracking and/or softening of pavements and road rutting
- the increased frequency and severity of rainfall events placing increased pressure on drainage infrastructure and/or resulting in flooding of the study area.

There were also additional events run through in the flood impact assessment modelling to capture the potential climate change and sea level rise impacts on flooding as a result of the Proposal. The peak flood depth for a standard 1% AEP 90-minute event is similar to an event with extra 30% of rainfall over the standard 1% AEP 90-minute event. The increased runoff in the extra is expected to have increased flood levels around the Hill Road and John Ian Wing Parade intersection. In addition, in an event modelled for potential sea level rise of 0.4 metres, there would be increased flood levels the Hill Road and John Ian Wing Parade intersection. Flooding impacts and safeguards are detailed in Section 6.2.

The Proposal is not likely to be any more susceptible to climate change risks than that of the existing road network. The minor contribution to greenhouse gas emissions are not considered to be significant. Further consideration of the climate change impact would be carried out during detailed design.

6.13.3 Safeguards and management measures

Table 6-44: Greenhouse gas and climate change safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction greenhouse	<p>Plant and equipment would be switched off when not in use.</p> <p>Vehicles, plant and construction equipment would be appropriately sized for the task and properly maintained so as to achieve optimum fuel efficiency.</p> <p>Materials would be delivered with full loads and would come from local suppliers, where possible.</p> <p>The energy efficiency and related carbon emissions would be considered in the selection of vehicle and plant equipment.</p>	Contractor	Construction	Additional safeguard

6.14 Other impacts

6.14.1 Existing environment and potential impacts

Table 6-45: Existing environment and potential impacts

Environmental factor	Existing environment	Potential impacts
Hazard and risk	<p>Hazardous materials and dangerous goods storage or handling of such materials are limited due to the industrial businesses in the area. Fuel and oil spills may occur as a result from vehicle passing through the study area.</p>	<p>Small quantities and inventories of hazardous materials and dangerous goods would be required during construction. As a result, the transport, use and storage of these materials would occur. A potential impact to soil and water quality and workforce safety may result from spills or inappropriate and inadequate handling and storage of material.</p> <p>The potential impact is not considered to be significant given the implementation of measures following the National Codes of Practice and Australian Standards for the storage and handling of dangerous goods and materials as well as the preparation of a Hazard and Risk Management Plan.</p>

6.14.2 Safeguards and management measures

Table 6-46: Other impacts safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Hazards and risk management	<p>A Hazard and Risk Management Plan (HRMP) would be prepared and implemented as part of the CEMP. The HRMP would 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 • record keeping arrangement, 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 would 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>	Contractor	Detailed design / pre-construction	Additional safeguard

6.15 Cumulative impacts

The interaction of individual elements of the Proposal and the additive effects of the Proposal with other concurrent and future projects have the potential to give rise to cumulative impact.

6.15.1 Methodology

The assessment identified committed and approved projects that would be built or would operate in the local area over the coming years or remote development that may indirectly affect the local area. Cumulative impacts result from a number of projects being constructed or operated at the same time which typically include the following:

- impacts on local, regional and State traffic, transport and road users
- social and economic effects, including changes to land use, access, settlements, employment and businesses
- changes to local and regional amenity including noise, vibration, visual quality and air quality

- environmental changes including effects on water quality, hydrology and biodiversity

A review was performed in the NSW Government Major Projects Planning Portal and the development application tracker for the City of Parramatta and Cumberland City Council.

The impacts of any development that is currently under construction but would be operational at the time the proposed modification is built has generally been considered as part of the existing baseline environment.

6.15.2 Other projects and developments

Projects and development occurring in the vicinity of the Proposal are shown in Figure 6-25. Table 6-47 detail cumulative impacts of related present and future projects.

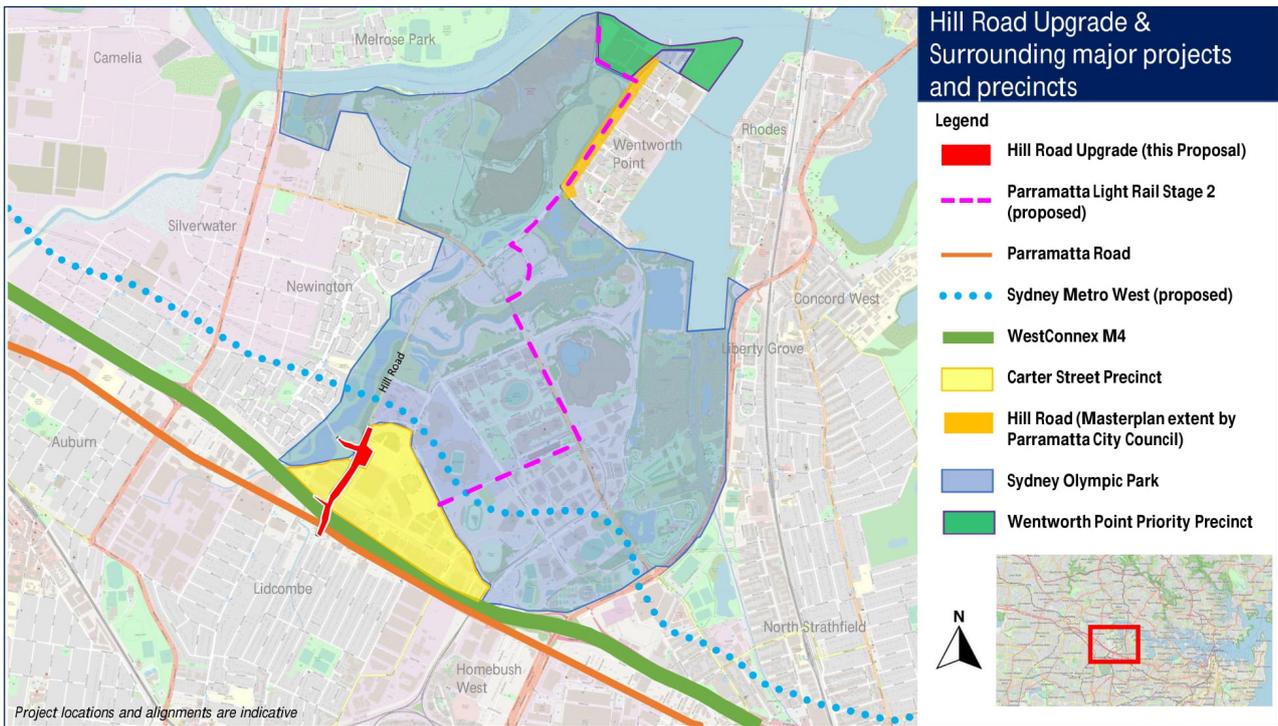


Figure 6-25: Overview of surrounding major projects and precincts

Table 6-47: Present and future projects

Project	Construction impacts	Operational impacts	Cumulative impact of the Proposal
<p>Carter Street Precinct</p> <p>The Precinct is part of a Master Plan which would be amended to the Auburn Local Environmental Plan 2010. The precinct would include 700 additional homes and three hectares of open space.</p> <p>The Carter Street Precinct Master Plan was finalised on 18 December 2020.</p>	<p>Expected construction impacts are:</p> <ul style="list-style-type: none"> • increased construction traffic from required workers and heavy vehicles • increased noise and vibration from construction activities to sensitive receivers • temporary visual and amenity impacts from construction compound and facilities • temporary business access impacts to surrounding local shops and businesses 	<p>Expected operational impacts are:</p> <ul style="list-style-type: none"> • increased traffic and noise from new residents and users of the future amenities • visual impacts of new residential buildings and precinct amenities • amenity benefits from improved landscaping and increased open space • residential and business benefit to the surrounding area from increased presence of amenities and residents 	<p>There would be cumulative impacts during construction and operation period across traffic, noise, visual and social.</p> <p>Identified impacts would be managed by mitigation measures described in Section 6.15.3.</p>
<p>Stadium Australia Redevelopment</p> <p>The redevelopment includes the following:</p> <ul style="list-style-type: none"> • reconfiguring the field • increasing the steepness of stands and reducing the distance of stands to the pitch • improving roof coverage to provide increased weather protection to spectators • providing new northern and southern entrances to improve access • improving the general amenities and facilities. <p>Per the EIS, construction would be 2.5 years commencing in October 2020.</p>	<p>Expected construction impacts are:</p> <ul style="list-style-type: none"> • increased traffic impacts from heavy vehicles and up to 300 construction workers • increased noise impacts to residential receivers in the Carter Street Precinct including the existing and future stages of developments • temporary business access impacts to surrounding local shops and businesses 	<p>Expected operational impacts are:</p> <ul style="list-style-type: none"> • reduced noise impacts due to increased shielding from the proposed extended roof • reduced parking demand and traffic generation due to reduced capacity of the stadium to accommodate • low visual impacts from the proposed changes to the northern and southern ends and the roof • business benefit to the surrounding area from increased presence of attendees 	<p>There would be cumulative impacts during construction as the Proposal and this project have similar timing and within proximity.</p> <p>During operations, there is not expected to be cumulative impacts.</p> <p>Identified impacts would be managed by mitigation measures described in Section 6.15.3.</p>

Project	Construction impacts	Operational impacts	Cumulative impact of the Proposal
<p>Sydney Olympic Park High School at Wentworth Point</p> <p>The project is for a new constructed high school to meet community demand and includes:</p> <ul style="list-style-type: none"> • facility catering for 850 students in stage 1 • additional capacity for 1,530 students in stage 2 • a playing field <p>The project's current status is preparing the EIS based on the issued SEARs on 23 December 2020.</p>	<p>Expected construction impacts are:</p> <ul style="list-style-type: none"> • increased construction traffic from required workers and heavy vehicles • increased noise and vibration from construction activities to sensitive receivers around Wentworth Point • temporary visual and amenity impacts from construction compound and facilities • temporary business and residential access impacts to surrounding local shops, businesses and residences. 	<p>Expected operational impacts are:</p> <ul style="list-style-type: none"> • increased traffic and noise and vibration from parents/caregivers dropping of/picking up students as well as required on-site staff and employees • visual and amenity impacts of a new structure adjacent to the future Wentworth Point Peninsula Public Park and marina • social benefit from the addition of an education facility for existing and new residences. 	<p>There would be cumulative impacts during construction as the Proposal and this project are likely to have similar timing and within proximity.</p> <p>During operations, there may be minor cumulative impacts as more users would be on Hill Road.</p> <p>Identified impacts would be managed by mitigation measures described in Section 6.15.3.</p>
<p>Hill Road Master Plan</p> <p>The Master Plan is a strategic implementation tool to transform Hill Road and the Wentworth Point area into an environmentally sustainable, liveable and resilient precinct. Key design features are:</p> <ul style="list-style-type: none"> • street layout reclamation of underutilised road space • safer active transport crossing points • drainage improvements • separated cycleway • planted median • space for future light rail corridor • improved safety through reduce speeds and narrower traffic lane widths. 	<p>Expected construction impacts are:</p> <ul style="list-style-type: none"> • increased construction traffic from required workers and heavy vehicles • increased noise and vibration from construction activities to sensitive receivers • temporary visual and amenity impacts from construction compound and facilities. • temporary business and residential access impacts to surrounding local shops, businesses and residences 	<p>Expected operational impacts are:</p> <ul style="list-style-type: none"> • traffic benefits for pedestrians from safer crossing points, enhanced active transport facilities and lower vehicle speeds • visual and amenity benefits from improved landscaping, vegetation and urban design • social benefit to surrounding businesses and residences for safer and better connections. 	<p>Construction and operation timing of this project was not known at the time of publication.</p> <p>If there are identified impacts during construction and/or operations, mitigation measures described in Section 6.15.3 would be applied.</p>

Project	Construction impacts	Operational impacts	Cumulative impact of the Proposal
<p>The City of Parramatta Council adopted the finalised plan on 12 July 2021.</p> <p>Parramatta Light Rail Stage 2</p> <p>The extension of the Stage 1 project connecting the Parramatta CBD to Ermington, Melrose Park, Wentworth Point and Sydney Olympic Park. It will have 10-12 stops over 10 kilometres.</p> <p>In June 2021, the NSW Government committed \$50 million towards planning, utilities and geotechnical investigations, as well as progressing the development of the project's EIS.</p>	<p>Expected construction impacts are:</p> <ul style="list-style-type: none"> • increased construction traffic from required workers and heavy vehicles • increased noise and vibration from construction activities to sensitive receivers • temporary visual and amenity impacts from construction compound and facilities • temporary business and residential access impacts to surrounding local shops, businesses and residences. 	<p>Expected operational impacts are:</p> <ul style="list-style-type: none"> • traffic benefits by providing an alternative mass transport mode in the area • visual and amenity benefits from improved landscaping, vegetation and urban design • social and business benefit by providing local and visitors travel to and from the area. 	<p>The construction timing of this project is unknown; however, it assumes the Proposal would be completed.</p> <p>It is not expected to have construction cumulative impacts. Operational cumulative benefits may occur at the completion of this project.</p>
<p>Sydney Metro West</p> <p>The project is an underground railway connecting Greater Parramatta and the Sydney central business district. The project will include a station at Sydney Olympic Park.</p> <p>The concept and stage 1 of the project phase was determined in July 2021. Ongoing assessment for rail infrastructure, stations, precincts and operations are ongoing during the preparation of the EIS. The project SEARs were provided August 2021.</p>	<p>Expected construction impacts are:</p> <ul style="list-style-type: none"> • increased construction traffic from required workers and heavy vehicles • increased noise and vibration from construction activities to sensitive receivers • temporary visual and amenity impacts from construction compound and facilities • temporary business and residential access impacts to surrounding local shops, businesses and residences. 	<p>Expected operational impacts are:</p> <ul style="list-style-type: none"> • traffic benefits by providing an alternative mass transport mode throughout the regional Sydney area • visual and amenity benefits from improved landscaping, vegetation and urban design at the identified stations including at Sydney Olympic Park • social and business benefit by providing local and visitors travel to and from the area. 	<p>The construction timing of this project is unknown; however, it assumes the Proposal would be completed.</p> <p>It is not expected to have construction cumulative impacts. Operational cumulative benefits may occur at the completion of this project.</p>

The following are other projects and plans identified near the Proposal that were reviewed and not identified to have any known cumulative impacts to the Proposal due to unknown timing and project details:

- Sydney Olympic Park Master Plan 2030 (2018 Review): as of September 2021, the updated master plan is in progress
- Parramatta Road Corridor Urban Transformation: last updated in July 2021 with no known project details or implementation date

6.15.3 Safeguards and management measures

Table 6-48: Cumulative impacts safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Cumulative construction impacts	The Consultation Plan would include consultation with proponents of the Carter Street Precinct, Stadium Australia Redevelopment, Sydney Olympic Park High School at Wentworth Point, Hill Road Master Plan, Parramatta Light Rail Stage 2 and Sydney Metro West projects to: <ul style="list-style-type: none"> • increase awareness of construction timeframes and impacts • coordinate impact mitigation and management such as respite periods. 	Contractor	Pre-construction	Standard safeguard C11 Section 4.2 of QA G36 <i>Environment Protection</i>
Cumulative construction impacts	The Contractor's CEMP would be revised as required to consider potential cumulative impacts from surrounding development activities as they become known. This would include input from consultation with the proponent and/or lead contractor	Contractor	Pre-construction and construction	Additional safeguard

7. Environmental management

This chapter describes how the Proposal would 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 Construction Environmental Management Plan (CEMP) would be prepared to describe the safeguards and management measures identified. The CEMP would provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

The CEMP would be prepared prior to construction of the Proposal and must be reviewed and certified by the Transport for NSW Environment Officer, Greater Sydney Division, prior to the commencement of any on-site works. The CEMP would be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in the QA Specification G36 – *Environmental Protection (Management System)*, QA Specification G38 – *Soil and Water Management (Soil and Water Plan)*, QA Specification G40 – *Clearing and Grubbing*, 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 proposed works 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
GEN1	General – minimise environmental impacts during construction	<p>A CEMP will be prepared and submitted for review and endorsement of the Transport for NSW 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 / Transport for NSW project manager	Pre-construction / detailed design	QA G36 <i>Environment Protection</i>
GEN2	General – notification	All businesses, residential properties and other key stakeholders (e.g. schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity.	Contractor / Transport for NSW project manager	Pre-construction	QA G36 <i>Environment Protection</i>
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. 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"> • threatened species habitat • adjoining residential areas requiring particular noise management measures 	Contractor / Transport for NSW project manager	Pre-construction / detailed design	QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B1	Biodiversity	<p>A Flora and Fauna Management Plan would be prepared in accordance with Transport for NSW's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects</i> (RMS, 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> (RMS, 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	Section 4.8 of QA G36 <i>Environment Protection</i>
B2	Vegetation	Native vegetation removal would be minimised through the detailed design process	Proposal design engineer	Detailed design	Additional safeguard
B3	Vegetation	Vegetation removal would be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011a).	Contractor	Construction	Additional safeguard
B4	Vegetation and habitat	<p>A detailed landscape plan would be prepared during detailed design and include detailed species and planting guides as well as areas disturbed for construction. Where areas of habitat are to be re-established, this would occur consistent with <i>Guide 3: Re-establishment of Native Vegetation of the Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011b).</p> <p>A detailed landscape plan would aim to:</p> <ul style="list-style-type: none"> enhance habitat reconstruct habitat in strategic areas to link areas of conservation value increasing buffer zones. 	Contractor	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B5	Vegetation and habitat	Exclusion zones would be set up at the limit of clearing in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011c). Exclusion zones would be established to avoid damage to native vegetation and fauna habitats identified for retention and prevent the distribution of weeds. The location of exclusion fencing to be installed would be identified by project environmental management plans and the function and importance of the exclusion zones would be communicated to construction personnel.	Contractor	Construction	Additional safeguard
B6	Vegetation and habitat	Weed species would be managed in accordance with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011d).	Contractor	Construction	Additional safeguard
B7	Vegetation and habitat	A weed management plan consistent with the <i>Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011e) would be developed as part of the construction environmental management plan. The weed management plan would include descriptions and mapping of major weed infestations and appropriate management actions to be undertaken in relation to each infestation.	Contractor	Construction	Additional safeguard
B8	Vegetation and habitat	Pest species would be managed within the study area.	Contractor	Construction	Additional safeguard
B9	Vegetation and habitat	Pathogens would be managed in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011f).	Contractor	Construction	Additional safeguard
B10	Vegetation and habitat	Measures to prevent the spread of pathogens would be detailed in the construction environmental management plan. Measures would be consistent with <i>Roads and Maritime Biodiversity Guidelines – Guide 7 Pathogen Management</i> (RTA, 2011g). This would include measures to minimise the spread of Chytrid fungus and would be implemented during construction.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B11	Habitat	Habitat removal would be minimised through detailed design.	Contractor	Detailed design	Additional safeguard
B12	Habitat	Pre-clearing surveys would be undertaken in accordance with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011c). Pre-clearing surveys would be undertaken by an experienced ecologist to identify any nesting/roosting animals present in the study area. This would include inspections of affected existing structures for microbats that may be present in cracks, fissures, scuppers, lifting holes or similar. An experienced ecologist would also be present during any clearing of native vegetation.	Contractor	Pre-construction	Additional safeguard
B13	Habitat	Pre-clearing surveys, if required, would be undertaken in accordance with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011c).	Contractor	Construction	Additional safeguard
B14	Habitat	The unexpected species find procedure would be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> ((RTA, 2011e)) if threatened flora species, not assessed in the biodiversity assessment, are identified in the study area.	Contractor	Construction	Additional safeguard
B15	Habitat	The unexpected species find procedure would be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011a) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the study area.	Contractor	Construction	Additional safeguard
B16	Habitat	Habitat removal would be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011a).	Contractor	Construction	Additional safeguard
B17	Habitat	Habitat would be replaced or re-instated in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011h), where possible.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
F1	Flooding	Appropriate sediment and erosion controls (as detailed in the construction environmental management plan (CEMP)).	Contractor	Construction	Additional safeguard
F2	Flooding	To reduce any potential flood impacts during construction, any stockpiles should be outside the 1% AEP flood extent. Where this is not possible, stockpiles should not be placed in floodways and suitable erosion control is used.	Contractor	Construction	Additional safeguard
F3	Flooding	If the site compound cannot be situated outside the 1% AEP flood extent, any site building should be above flood planning level (1% AEP = 0.5m freeboard) and a site management plan that can reduce flood losses to personnel and equipment is developed and followed.	Contractor	Construction	Additional safeguard
F4	Flooding	Any works on existing drainage networks should be scheduled with consideration of rain / flash flood forecasts provided by the Bureau of Meteorology.	Contractor	Construction	Additional safeguard
WQ1	Soil and water	A Soil and Water Management Plan (SWMP) would be prepared and implemented as part of the CEMP. The SWMP would identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks would be addressed during construction.	Contractor	Detailed design / pre-construction	Section 2.1 of QA G38 <i>Soil and Water Management</i>
WQ2	Soil and water	The SWMP would a site-specific Erosion and Sediment Control Plan/s 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	Section 2.2 of QA G38 <i>Soil and Water Management</i>
WQ3	Soil and water	The SWMP would be prepared for the project in accordance with: Managing Urban Stormwater–Soils and Construction, Volume 1 Managing Urban Stormwater, 4th edition ('the Blue Book'). Managing Urban Stormwater–Soils and Construction, Volume 2D Main Road Construction.	Contractor	Detailed design / Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
WQ4	Erosion and sedimentation (Construction)	<p>Measures would be implemented during construction to minimise the risk of erosion, sedimentation and pollution. These measures may include:</p> <ul style="list-style-type: none"> • avoid disturbance where practicable, otherwise minimise the area of disturbance, particularly on and adjacent to river banks. • designate of 'no-go' zones for construction plant and equipment • install upstream diversion channels to direct clean runoff from upstream catchments around or through disturbed areas (maintaining separation from runoff containing sediment) • shape disturbed land to minimise slope lengths and gradients and improve drainage • install/line catch drains to carry any sediment laden runoff to appropriate sediment control measures • minimise stockpiling of material • remove cleared or excavated materials as soon as practicable after excavation and appropriately dispose of or stockpile off-site • locate stockpiles away from drainage lines and creek channels • seed disturbed areas for temporary soil stabilisation • employ appropriate measures to prevent/minimise wind-blown dust from leaving the site (e.g. watering) • establish designated areas for plant and construction material storage within site compounds and other locations within the Proposal • store all chemicals and fuels associated with construction in secure roofed and bunded areas • retain erosion and sediment controls until disturbed areas are stabilised. 	Contractor	Construction	Additional safeguard
WQ5	Erosion and sedimentation (Operation)	Measures would be implemented during operation to minimise the risk of erosion and sedimentation. These measures may include monitoring and remediation during schedule road maintenance of planting where vegetation cover has not established or has only partially established.	Transport for NSW	Operation	Additional safeguard
WQ6	Water quality	Detailed design would consider practicable measures to optimise pollution mitigation, and accidental oil/fuel spill containment. This would include GPTs or similar proprietary products.	Transport for NSW	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
WQ7	Water quality	Oil/fuel spill mitigation measures would be incorporated into the longitudinal drainage system (e.g. sandbagging of last pit in the drainage network following a spill event) as the longitudinal drainage system has been designed to be separate to any transverse drainage systems, in accordance with good practice and Transport for NSW water management policy.	Transport for NSW	Detailed design	Additional safeguard
WQ8	Water quality	Suitable protection measures would be provided at pipe outlets and at locations where there is a risk of creek bank instability due to discharges from the pavement drainage system.	Transport for NSW	Detailed design	Additional safeguard
C1	Contaminated land	<p>A Contaminated Land Management Plan would be prepared in accordance with the <i>Guideline for the Management of Contamination</i> (TfNSW, 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>
C2	Contaminated land	If contaminated areas are encountered during construction, appropriate control measures would be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area would 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 Transport for NSW Environment Manager and/or EPA.	Contractor	Detailed design / Pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
C3	Accidental spill	A site specific emergency spill plan would be developed, and include spill management measures in accordance with the Transport for NSW <i>Code of Practice for Water Management</i> (RTA, 1999) and relevant EPA guidelines. The plan would address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport for NSW and EPA officers).	Contractor	Detailed design / Pre-construction	Section 4.3 of QA G36 <i>Environment Protection</i>
C4	Contaminated land	An Asbestos Management Plan would be developed for the construction of the Proposal in accordance with the National Environment Protection (Assessment of site contamination) Measure 1999. The Plan would include an unexpected finds procedure to address any previously unidentified asbestos contamination encountered during construction.	Contractor	Pre-construction	Additional safeguard
C5	Excavation	Excavated material that is not suitable for onsite reuse or recycling would be transported to a site that may legally accept that material for reuse or disposal. Soils leaving the site will be waste classified so that correct resource recovery and or off-site disposal occur.	Contractor	Construction	Additional safeguard
C6	Excavation	Where excavated material cannot be classified as virgin excavated natural material, it would be classified and disposed of to an appropriately licensed landfill in accordance with the Waste Classification Guidelines–Part 1: Classifying Waste and Part 2: Immobilisation of Waste.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
T1	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 Transport for NSW <i>Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10 Control of Traffic</i> (TfNSW, 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. 	Contractor	Detailed design / Pre-construction	Section 4.8 of QA G36 Environment Protection
T2	Traffic and transport	Where possible, current traffic movements and property access are to be maintained during the works. Any disturbance is to be minimised to prevent unnecessary traffic delays.	Contractor	Construction	Additional safeguard
T3	Traffic and transport	Comply with Council requirements regarding traffic control, access and road/ pedestrian access.	Contractor	Construction	Additional safeguard
T4	Traffic and transport	<p>The following measures would be applied during event day traffic:</p> <ul style="list-style-type: none"> • consultation with SOPA • where possible, current traffic movements and property access are to be maintained during the event. Any disturbance is to be minimised to prevent unnecessary traffic delays • if traffic disturbance is unavoidable, a TMP would be prepared 	SOPA	Construction & Operation	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
N1	Noise and vibration	<p>A Noise and Vibration Management Plan (NVMP) would be prepared and implemented as part of the CEMP. The NVMP would generally follow the approach in the Interim <i>Construction Noise Guideline</i> (ICNG) (DECC, 2009) and identify:</p> <ul style="list-style-type: none"> • all potential significant noise and vibration generating activities associated with the activity • feasible and reasonable mitigation measures to be implemented, taking into account <i>Beyond the Pavement: urban design policy, process and principles</i> (TfNSW, 2014) • a monitoring program to assess performance against relevant noise and vibration criteria • arrangements for consultation with affected property owners 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. 	Contractor	Detailed design / Pre-construction	Standard safeguard NV1 Section 4.6 of QA G36 <i>Environment Protection</i>
N2	Noise and vibration	<p>All sensitive receivers likely to be affected would be notified at least seven days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification would provide details of:</p> <ul style="list-style-type: none"> • the Proposal • the construction period and construction hours • contact information for project management staff • complaint and incident reporting. 	Contractor	Detailed design / Pre-construction	Standard safeguard NV2 Section 4.6 of QA G36 <i>Environment Protection</i>
N3	Noise	Where feasible, the use of noisy equipment such as jackhammers, vibratory rollers and profilers should be confined to standard hours or should be scheduled to be carried out early in the evening or night period.	Contractor	Construction	Additional safeguard
N4	Noise	Provide periods of respite from the use of noise intensive plant. Respite periods should be increased during periods where the community is more sensitive to noise such as evening and night-time hours.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
N5	Noise	Notify the community before starting any noise intensive work in accordance with the community consultation strategy.	Contractor / Transport for NSW	Construction	Additional safeguard
N6	Noise	Orientate stationary and directional noise sources away from sensitive receivers.	Contractor	Construction	Additional safeguard
N7	Noise	Use vehicles, obstacles and stockpiles onsite to provide shielding to receivers, especially for static noise sources.	Contractor	Construction	Additional safeguard
N8	Noise	Use equipment that has noise levels equal to or less than the sound power levels as defined in Appendix H.	Contractor	Construction	Additional safeguard
N9	Noise and vibration road traffic	<p>Measures to reduce potential impacts from construction traffic:</p> <ul style="list-style-type: none"> • specifying designated travel routes to and from the project site to avoid local roads and roads where residential receivers are potentially impacted • restricting deliveries to standard working hours where possible • prohibiting the use of engine/compression brakes in or near residential areas • promoting driving behaviour that reduces potential noise impacts • prohibiting engine be left idling near residential receivers when not in use • strategic positioning of site accesses to minimise the chance of trucks passing by residential receivers, especially at night. 	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
N10	Sleep disturbance	<p>Measures to reduce sleep disturbance:</p> <ul style="list-style-type: none"> works outside of standard hours should be performed in accordance with the CNVG scheduled activities that are likely to cause maximum noise events such as deliveries, moving material or equipment, compacting and demolition works to avoid the night-time period (10pm to 7am) avoid dropping tools or materials from height, striking materials, dragging materials or making metal on metal contact educate workers on the importance of minimising noise and avoid creating short duration high noise level events inform surrounding residents by mail, email or SMS of planned works prior to the works commencing. 	Contractor	Construction	Additional safeguard
N11	Vibration	<p>Measures to minimise the risk of vibration impacts:</p> <ul style="list-style-type: none"> the required locations for vibration intensive equipment would be reviewed during detailed design when more specific information is available all equipment would be maintained and operated in an efficient manner, in accordance with manufacturer's specifications, to reduce the potential for adverse vibration impacts ensure safe working distances where work is required within the nominated safe working distances objectives for human comfort, implementation of additional vibration mitigation measures would follow as outlined in Appendix H 	Contractor	Construction	Additional safeguard
N12	Vibration	<p>If vibration intensive equipment is to be used within the safe working distances, the following would apply:</p> <ul style="list-style-type: none"> lower powered equipment to be considered attended vibration monitoring or vibration trials would be undertaken when proposed works are within the safe working distances to ensure that levels remain below the criterion as described in Appendix H. 	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
N13	Vibration	To minimise potential vibration impacts to the heritage listed item, the following would be considered: <ul style="list-style-type: none"> pre-construction arborist survey and advise safe working distances regular surveys of the trees 	Contractor	Construction	Additional safeguard
N14	Operational noise and vibration	The following would be explored to minimise operational noise and vibration impacts to the residential receivers: <ul style="list-style-type: none"> confirmation and review of land use status quieter pavement surfaces noise mounds and noise walls at-property treatments Further details are described in Appendix H.	Transport for NSW	Operation	Additional safeguard
H1	Aboriginal heritage	A <i>Standard Management Procedure - Unexpected Heritage Items</i> (TfNSW, 2015) would be implemented as part of the CEMP. It would provide specific guidance on measures and controls to be implemented for managing unexpected impacts on Aboriginal heritage.	Contractor	Detailed design / pre-construction	Section 4.9 of QA G36 <i>Environment Protection</i>
H2	Non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan (NAHMP) would be prepared and implemented as part of the CEMP. It would provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage.	Contractor	Detailed design / pre-construction	Section 4.10 of QA G36 <i>Environment Protection</i>
H3	Non-Aboriginal heritage	<i>The Standard Management Procedure - Unexpected Heritage Items</i> (TfNSW, 2015) would be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. Work would 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>
H4	Non-Aboriginal heritage	Commitment to not destroying, modifying or physically affecting any heritage items outside of the study area.	Contractor	Detailed design / pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
H5	Non-Aboriginal heritage	Ensuring the Proposal's urban design considers local heritage values	Proposal design engineer	Detailed design	Additional safeguard
H6	Non-Aboriginal heritage	Ensuring that any new ancillary facility locations avoid heritage impacts and secure the necessary approvals. The revegetation of affected areas, including within the curtilage of heritage item I20, with similar species of trees, shrubbery and seedlings.	Proposal design engineer	Detailed design / pre-construction	Additional safeguard
H7	Non-Aboriginal heritage	Preparing management guidelines under the CEMP to protect tree roots, trunks, branches and tree crowns and to avoid working within any tree drip lines.	Contractor	Construction	Additional safeguard
H8	Non-Aboriginal heritage	Protection of heritage item A52 if there is any future proposals to work within the curtilage of the item.	Contractor	Construction	Additional safeguard
S1	Socio-economic	<p>A Communication Plan would be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The plan would 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 plan would be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008).</p>	Contractor / Transport for NSW	Pre-construction, Construction	SE1 QA G36 <i>Environment Protection</i>
S2	Socio-economic	Early and on-going communication and consultation would occur with property owners, business owners and residents about the property acquisition process.	Transport for NSW	Pre-construction	Additional safeguard
S3	Property acquisition	All property acquisition will be carried out in accordance with the <i>Land Acquisition Information Guide</i> (TfNSW, 2012) and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i>	Transport for NSW	Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
S4	Socio-economic	On-going communication and consultation with the owners of the impacted businesses would occur. This would include working with the business owners to manage and plan project construction activities and delivery to minimise impacts on their business operations.	Transport for NSW	Pre-construction	Additional safeguard
S5	Socio-economic	Ensure that works consider other active or planned construction projects in the area and that traffic and construction impact management approaches align to reduce cumulative impacts where possible. Consultation with local councils and relevant authorities could assist in early identification and mitigation.	Transport for NSW	Pre-construction, Construction	Additional safeguard
A1	Air quality	<p>An Air Quality Management Plan (AQMP) would be prepared and implemented as part of the CEMP. The AQMP would 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 • compliance with Stockpile Site Management Guidelines (Roads and Maritime, 2015) • methods to manage work during strong winds or other adverse weather conditions • a progressive rehabilitation strategy for exposed surfaces. 	Contractor	Detailed design	Standard safeguard AQ1 Section 4.4 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
W1	Waste	<p>A Waste Management Plan (WMP) would be prepared and implemented as part of the CEMP. The WMP would include but not be limited to:</p> <ul style="list-style-type: none"> • measures to avoid and minimise • waste associated with the Proposal • 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 would be prepared taking into account the Environmental Procedure - Management of Wastes on Roads and Maritime Services Land (RMS, 2014) and relevant Transport for NSW Waste Fact Sheets.</p>	Contractor	Pre-construction	Standard safeguard WR1 Section 4.2 of QA G36 <i>Environment Protection</i>
W2	Waste	Waste material would not be left on site once the work has been completed	Contractor	Construction	Standard safeguard WR2 Section 4.2 of QA G36 <i>Environment Protection</i>
W3	Waste	All wastes, including contaminated wastes, would be identified and classified in accordance with Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes. Disposal of any non-recyclable waste will be in accordance with the POEO Act and Waste Classification Guidelines: Part 1 Classifying Waste.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
G1	Construction greenhouse	<p>Plant and equipment would be switched off when not in use. Vehicles, plant and construction equipment would be appropriately sized for the task and properly maintained so as to achieve optimum fuel efficiency.</p> <p>Materials would be delivered with full loads and would come from local suppliers, where possible. The energy efficiency and related carbon emissions would be considered in the selection of vehicle and plant equipment.</p>	Contractor	Construction	Additional safeguard
HR1	Hazards and risk management	<p>A Hazard and Risk Management Plan (HRMP) would be prepared and implemented as part of the CEMP. The HRMP would 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 • record keeping arrangement, 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 would 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>	Contractor	Detailed design / pre-construction	Additional safeguard
CI1	Cumulative construction impacts	<p>The Consultation Plan would include consultation with proponents of the Carter Street Precinct, Stadium Australia Redevelopment, Sydney Olympic Park High School at Wentworth Point, Hill Road Master Plan, Parramatta Light Rail Stage 2 and Sydney Metro West projects to:</p> <ul style="list-style-type: none"> • increase awareness of construction timeframes and impacts • coordinate impact mitigation and management such as respite periods. 	Contractor	Pre-construction	Standard safeguard C11 Section 4.2 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
CI1	Cumulative construction impacts	The Contractor's CEMP would be revised as required to consider potential cumulative impacts from surrounding development activities as they become known. This would include input from consultation with the proponent and/or lead contractor	Contractor	Pre-construction and construction	Additional safeguard

7.3 Licensing and approvals

Table 7-2: Summary of licensing and approvals required

Instrument	Requirement	Timing
Protection of the Environment Operations Act 1997 (s43)	Environment protection licence (EPL) for scheduled activities such as road construction from the EPA.	Prior to start of the activity.
Protection of the Environment Operations Act 1997 (s43)	Environment protection licence (EPL) for non-scheduled activities for the purposes of regulating water pollution.	Prior to start of the activity.
Environmentally Hazardous Chemicals Act 1985 (s28)	A licence to carry on any prescribed activity with respect to an environmentally hazardous chemical or a declared chemical waste from the EPA.	Prior to start of the activity
Water Management Act 2000 (s91C)	Drainage work approval from DPI (Water).	Prior to start of the activity.
Water Management Act 2000 (s91D)	Flood work approval from DPI (Water). [Note exemption under s41E of the Water Management (General) Regulation 2011.]	Prior to start of the activity.
Roads Act 1993 (s138)	If required, a road occupancy licence may be required in consultation with Cumberland Council and/or City of Parramatta Council	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

While there would be some environmental impacts as a consequence of the Proposal including impacts to biodiversity, flooding, water quality, traffic, noise and vibration, non-Aboriginal heritage, landscape visual and socio-economic they have been avoided or minimised wherever possible through design, standard and site-specific mitigation measures and safeguards.

Compared with the 'do minimum' option, the Proposal would have beneficial effects of traffic safety and efficiency improvements to Hill Road. The identified impacts in this REF would outweigh the identified impacts and risks associated with this Proposal.

8.1.1 Social factors

As documented in Section 6.10 of this REF, there could be some short-term negative social impacts as a result of the Proposal. The combined effect of construction noise, traffic delays and temporary changes to access to local businesses and residences as well as general disturbance caused by construction activity, and associated construction traffic would result in a general temporary loss of amenity for residents, road users, business owners and others who live near the Proposal. The partial and full property acquisitions would also result in minor social impacts.

Speed restrictions, traffic delays and traffic alternate routes have the potential to increase travel time for roads users of Hill Road.

Compared with the 'do nothing' option where Hill Road is not upgraded; the long-term effect would be an overall social benefit from the Proposal.

8.1.2 Biophysical factors

The Proposal would remove about 0.67 hectares of communities listed threatened species or ecological communities or their habitats, within the meaning of the BC Act. No street trees were identified for removal during construction.

The Proposal is not likely to significantly impact threatened species or ecological communities or their habitats, within the meaning of the BC Act or FM Act and therefore a Statement of Significance or BDAR is not required.

The Proposal is not likely to significantly impact threatened species, ecological communities or migratory species, within the meaning of the EPBC Act.

8.1.3 Economic factors

The Proposal would result in changes to parking, road, public transport and active transport. Resident and employee journeys may be delayed or extended using detour routes, altered bus routes and adjusted footpaths during construction of the Proposal.

Residents and businesses may also experience amenity loss during construction of the Proposal due to associated noise, traffic movements, work activities and presence of construction plant and equipment.

The Proposal would acquire 0.5 hectares of land for widening of Hill Road. It should be noted that Lot 302/DP541070 would be a full acquisition (8,357 square metres) for the construction compound; however at the completion of the Proposal, 3,757 square metres would be returned to City of Parramatta Council.

There may also be positive effects for local businesses from increased patronage from the construction work.

8.1.4 Public interest

The Proposal would improve road user safety with improved geometry and a new shared user path on Hill Road. In addition, the Proposal would support connectivity to the Carter Street Precinct and Sydney Olympic Park Precinct.

The Proposal would improve access to community and recreational facilities and further work to build community values, as well as improved facilities for cyclists and pedestrians.

As a result, the Proposal is considered to be in the public interest as the upgrades to road infrastructure fulfil the needs of the majority. The Proposal represents a cost-efficient investment in public infrastructure to maximise the long-term social and economic benefits, while minimising the long-term negative impacts on communities and the environment. During the construction phase, the Proposal would result in some short-term impacts on visual amenity, traffic and noise.

Compared with the 'do minimum' option, these impacts would be outweighed by the long-term benefits of the Proposal. The overall result would be improved safety and traffic efficiency outcomes once the Proposal is operational.

8.2 Objects of the EP&A Act

Object	Comment
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	The Proposal would improve the transport network while minimising impacts on the natural and built environment. It is therefore consistent with the objective of promoting the social and economic welfare of the community and a better environment.
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	Ecologically sustainable development is considered in Section 8.2.1.
1.3(c) To promote the orderly and economic use and development of land.	The Proposal supports the objectives of the Carter Street Precinct Master Plan, Hill Road Master Plan and Sydney Olympic Park Master Plan through providing critical transport infrastructure to these key development areas.

Object	Comment
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the Proposal.
1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	The Proposal would have some impact on the natural environment detailed in Section 6.1. Measures have been proposed to mitigate the impact and included in Section 7.2.
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The Proposal would have no impact to Aboriginal cultural heritage. The Proposal would have minor impacts to Non-Aboriginal heritage from direct physical impacts to LEP item I20; however, it would be mitigated through a revegetation procedure and site surveying of an arborist. Refer to Sections 6.7 and 6.8 respectively for detail of potential impacts.
1.3(g) To promote good design and amenity of the built environment.	The Proposal has been developed with reference to the urban design standards and principles outlined in Section 2.2.2.
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Not relevant to the Proposal.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	Not relevant to the Proposal.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	Community involvement has occurred during the Proposal's development. Refer to Chapter 5 for further details.

8.2.1 Ecologically sustainable development

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been an integral consideration throughout the development of the project. ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD are discussed below.

The precautionary principle

The precautionary principle deals with reconciling scientific uncertainty about environmental impacts with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation. This principle was considered during the options assessment (refer to Chapter 2). The precautionary principle has guided the assessment of environmental impacts for this REF and the development of mitigation measures.

Specialist studies were undertaken for the following issues to provide accurate and impartial information for the evaluation of options and development of the Proposal:

- Traffic and transport
- Noise and vibration
- Hydrology and flooding
- Non-Aboriginal heritage
- Socio-economic
- Landscape character and visual
- Biodiversity
- Contamination

In developing the Proposal, the best available technical information, environmental standards and measures have been used to minimise environmental risks. The preferred option minimises vegetation clearance, with particular consideration of sensitive areas. The preferred option minimises potential impacts of property acquisition and other existing land uses, while also taking into consideration supporting the future land use and development of the area.

Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations.

The preferred option was chosen to:

- minimise the environmental impact such as vegetation clearance and non-aboriginal heritage
- improve flood immunity to allow the road to be serviceable for future generations
- provide for the future traffic to support the Carter Street Precinct, Hill Road Master Plan and Sydney Olympic Park Precinct
- improve road safety.

Conservation of biological diversity and ecological integrity

This principle reinforces the previous two principles in requiring the diversity of genes, species and communities, as well as the ecosystems and habitats to which they belong, be maintained and improved to ensure their survival.

As part of the assessment process, a comprehensive assessment of the existing local environment has been carried out to recognise and manage any potential impacts of the Proposal on local biodiversity. The Proposal would not significantly impact biological diversity or ecological integrity. An ecological assessment and appropriate site-specific safeguards are provided in Section 6.1.4 and Appendix D.

Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources which may be affected by the carrying out of a project, including air, water, land and living things.

This REF has examined the environmental consequences of the Proposal and identified mitigation measures for areas that may possibly experience adverse impacts. Implementation of these mitigation measures would increase the capital costs of the Proposal. This shows environmental resources were valued in economic terms during concept design. In addition, the concept design was developed with an objective of minimising potential impacts on the surrounding environment, thereby minimising costs to the environment.

In summary, the Proposal is generally in accord with the principles of ESD. The Proposal would improve traffic movement and would provide a sustainable balance between environmental and economic objectives. It would also provide better facilities for pedestrians, cyclists and vehicles.

8.3 Conclusion

The Proposal is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration (where relevant) of conservation agreements and plans of management under the NPW Act, biodiversity stewardship sites under the BC Act, wilderness areas, areas of outstanding value, impacts on threatened species and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the 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 impacts on biodiversity, flooding, water quality, traffic, noise and vibration, non-Aboriginal heritage, landscape visual and socio-economic. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The Proposal would also improve road safety, provide enhanced active transport networks, minimise road flooding issues and support future development of nearby precincts.

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 and Public Spaces 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 City of Parramatta 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 *Environment Protection and Biodiversity Conservation Act 1999*. A referral to the Australian Department of Agriculture, Water and the Environment 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.



Glyn Diwell
Principal Environmental Scientist
WSP

Date: 5 November 2021

I have examined this review of environmental factors and accept it on behalf of Transport for NSW.



Jennifer Mak
Senior Project Development Manager
Infrastructure and Place

Date: 5 November 2021

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Terms and acronyms used in this REF

Term / Acronym	Description
AEP	Annual exceedance probability
AHD	Australian height datum
AHIMS	Aboriginal Heritage Information Management System
ASS	Acid sulfate soil
BC Act	<i>Biodiversity Conservation Act 2016</i> (NSW).
CEMP	Construction environmental management plan
CNVG	Construction Noise and Vibration Guideline
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DECCW	Department of Environment, Climate Change and Water
DPIE	NSW Department of Planning, Industry and Environment
DSI	Detailed site investigation
EIA	Environmental impact assessment
EPA	NSW Environmental Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
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
pHF	Field pH
FM Act	<i>Fisheries Management Act 1994</i> (NSW)
GPT	Gross Pollutant Traps
Heritage Act	<i>Heritage Act 1977</i> (NSW)
ICOMOS	International Council on Monuments and Sites
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LoS	Level of Service. A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers.
MNES	Matters of national environmental significance under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
NPW Act	<i>National Parks and Wildlife Act 1974</i> (NSW)
pHFOX	Oxidised field pH
PCT	Plant Community Types
Phase 1	Phase 1 Contamination Assessment
pHF	field PH
TSS	Total Suspended Soils
REF	Review of Environmental Factors
Roads and Maritime	NSW Roads and Maritime Services, now known as Transport for NSW
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SOHI	Statement of Heritage Assessment
TMP	Traffic Management Plan
TN	Total Nitrogen

Term / Acronym	Description
TP	Total Phosphorous
Transport for NSW	Transport for New South Wales
The Proposal	The design/operational footprint
WQOs	Water Quality Objectives

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