Gateway to the South Pinch Points Program, Princes Highway, Acacia Road, Oak Road and Kingsway, Kirrawee

Review of environmental factors
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May 2017
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RMS 17.253

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## Approval and authorisation

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| **Accepted on behalf of NSW Roads and Maritime Services by:** | Robin Ferdous  
Project Manager – South Pinch Points  
Easing Sydney’s Congestion |
| **Signed:** | ![Signature] |
| **Dated:** | 15 May 2017 |
Executive summary

The proposal

The Princes Highway is an important access route for traffic, including freight, between the south coast, Victoria and the Sydney CBD. As the main arterial road in Kirrawee, the Princes Highway carries about 60,000 to 70,000 vehicles per day.

Roads and Maritime Services (Roads and Maritime) propose to upgrade the Princes Highway between Auburn Street and Kingsway in Kirrawee. The proposal involves the provision of additional through lanes and new intersection configurations at Oak Road, Acacia Road and Kingsway, which would ease congestion and improve traffic flow along the corridor.

The proposal includes:

- Remove part of the existing median kerb near Auburn Street to provide a third north bound lane
- Provision of a retaining wall along the Princes Highway in front of the vacant land at 642 Princes Highway (next to Bupa Aged Care Home), up to Acacia Road North
- Upgrades to the Princes Highway and Acacia Road intersection
  - Additional north bound right turn lane on Princes Highway at Acacia Road
  - Additional south bound through lane on Princes Highway at Acacia Road
- Widening between Acacia Road and Oak Road on the northern side of the Princes Highway to provide a fourth south bound lane
- Closure of Kenneth Avenue access and exit from Princes Highway.
- Upgrade the service road between Acacia Road and Oak Road:
  - Provision of a retaining wall between the Princes Highway and the service road.
  - Provide landscaping along the shared path
  - Access to the shared path from Kenneth Avenue would continue to be available
- Upgrades to the Princes Highway and Oak Road intersection:
  - Permanent removal of right turn movements from Princes Highway turning into Oak Road from both north bound and south bound lanes (in addition to the current peak period ban in place)
  - Provision of additional north bound and south bound through lanes accommodated through the removal of right turn lanes from Princes Highway to Oak Road
  - Dedicated shared left and through lane into Oak Road from Princes Highway north bound
  - New slip lane into McDonalds Kirrawee
• Widening between Oak Road and Kingsway on the northern side of the Princes Highway to provide a fourth north bound lane

• Upgrades to the Princes Highway and Kingsway intersection:
  – Additional north bound right turn lane from Princes Highway to Kingsway
  – Lengthened left turn filter lane from Princes Highway south bound to Kingsway.

• Utilities relocation and adjustments are also proposed, in order to construct the above works, in accordance with the requirements for each existing utility asset.

In addition to these capacity enhancements, the following local enhancements are proposed for non-motorised trips and amenity:

• Enhanced pedestrian crossing facilities at the intersections; including an additional pedestrian crossing across the Princes Highway at Oak Road on the eastern approach and a staggered pedestrian crossing across the Princes Highway at Kingsway on the eastern approach

• Enhanced local shared service road parallel to Princes Highway between Acacia Road and Oak Road.

Other activities associated with the proposal include:

• Adjustments to driveway entrances along the length of the realigned service road (from Acacia Road to Oak Road) and commercial and retail properties from Oak Road to Kingsway intersection

• Installation of formalised kerbs, pram ramps and minor footpath modifications

• Provide new line marking and signage

• Realignment of the existing VMS sign in front of the McDonalds to the edge of the new kerb

• Provide new pavement and re-asphalt

• Sydney Water main adjustment near the intersection of the Old Princes Highway and Merton Street

• Temporary infrastructure to allow project works including site compounds, sedimentation and erosion control, stockpiling sites and other infrastructure as required.

Note, for the length of the proposal the Princes Highway runs in an east west direction (and vice versa). However, as the Princes Highway provides a north south link between Sydney and Wollongong, for the purposes of the REF through lanes travelling in a west direction are referred to as ‘south bound’, and through lanes travelling in an east direction are referred to as ‘north bound’ to better reflect the direction of travel within the Princes Highway corridor. Intersection approach descriptions remain aligned with the actual direction of travel at the intersection.
**Need for the proposal**

This section of the Princes Highway is limited in its operational efficiency. The Princes Highway is important to the Sydney road network as it connects the M1 Princes Motorway south of Waterfall to Sydney’s roads. The Princes Highway has also been identified as one of the corridors south of the M5 Motorway.

The Princes Highway currently contains pinch points which cause congestion through the region. This section of the Princes Highway consists of three intersections, two which have heavy through movements (Princes Highway at Acacia Road and Princes Highway at Oak Road) and one which has a heavy right turn (Kingsway intersection). Delays in travel times range from a maximum of 78.6 seconds in the PM peak and 51.8 seconds in the AM peak. In a five year period between 2009 and 2014, a combined total of 154 crashes at the three intersections was recorded.

The provision of additional lanes and new intersection configurations would ease congestion and improve traffic flow along the corridor. It would also improve pedestrian crossing facilities and access across the proposal footprint.

**Proposal objectives and development criteria**

The key objectives of the proposal are consistent with the objectives of the Gateway to the South Pinch Points Program (refer to Section 2.1.2), and include:

- **Objective 1** - Improve the operational efficiency, ease traffic congestion and improve consistency of travel times for motorists on the Princes Highway corridor, specifically the Acacia Road, Oak Road and Kingsway intersections
- **Objective 2** - Improve traffic flow whilst maximising use of road space
- **Objective 3** - Improve road safety and minimise non-recurrent congestion events
- **Objective 4** - To deliver a value-for-money solution and deliver a positive benefit-cost ratio
- **Objective 5** - Minimise impacts to land use and the community, including requirements for property acquisition and utility adjustments
- **Objective 6** - Minimise impacts to the local environment including adjacent bushland, whilst enhancing urban design and transport outcomes.

**Options considered**

A base case ‘do nothing’ option and three options were considered for this proposal:

- A theoretical base case or ‘do nothing’ option – This would involve no upgrade to the existing Princes Highway alignment. It assumes only ongoing maintenance of the existing road
- **Upgrade Option 1** - upgrades and widening along the existing road alignment including a dual left-out of Kingsway to Princes Highway south bound
- **Upgrade Option 2** - upgrades and widening along the existing road alignment, retaining the existing single left-out of Kingsway to Princes Highway south bound.
The preferred option (Option 2) is an upgrade and widening of Princes Highway between Auburn Street and Kingsway at Kirrawee. The option includes upgrades to three intersections along the Princes Highway including Acacia Road, Oak Road and Kingsway, retaining the existing single left-out of Kingsway to Princes Highway south bound.

**Statutory and planning framework**

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

As the proposal is for a road and is to be carried out by Roads and Maritime, it can be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required.

**Community and stakeholder consultation**

This Review of Environmental Factors (REF) will be displayed for community comment and activities being considered for directly affected residents and businesses include mail outs and door knocking to discuss the proposal. Any submissions received will be considered in finalising the details of the proposal.

**Environmental impacts**

A summary of the main environmental impacts associated with the proposal is provided below.

**Biodiversity**

The proposal would require the removal of trees from the proposal area, some of which were recently planted and are of little to no habitat value for fauna. Due to the mostly scattered layout of the trees along the verge and their location along a busy and noisy highway, it is unlikely that any native fauna species would be dependent on these trees. The two potential compound sites would not impact biodiversity as they have been used for this purpose in the past and are already cleared. Two clusters of trees located within the proposal are of local heritage significance. The proposal is not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the TSC Act or *Fisheries Management Act 1994* and therefore a Species Impact Statement is not required.

**Soils**

The proposal falls within the Gymea Soil Landscape unit. Potential impacts on the soils, topography and geology of the proposed construction works would primarily be associated with the erosion of exposed soils and stockpiles, and associated potential sedimentation of surrounding land and stormwater infrastructure. There is expected to be minimal impact on landform and soils following completion of construction and once disturbed areas have been stabilised. The proposal has been previously disturbed by the construction of the Princes Highway. The Sydney Water main adjustment is located at a...
grassed area to the north of the carpark on the Old Princes Highway, (approximately 70 metres east of the Merton Street intersection, has been disturbed prior to this proposal.

Traffic and transport
During construction, temporary traffic capacity reductions would be required. Additional vehicle movements would be generated along the Princes Highway and surrounding road network, particularly between the compound sites and the construction areas. Heavy vehicle traffic would use the regional road network, Princes Highway and Kingsway, for access routes to and from construction areas. Traffic disruptions would be minimised as the majority of construction activities would occur outside of standard construction hours. Properties along the Princes Highway and Oak Road would be impacted by construction works during the proposal. Disruption to existing property access would be minimised and would only be undertaken following consultation with the community and individual property owners/occupiers affected by the works.

Access to Kenneth Avenue would be permanently removed under the proposal. In addition, the permanent removal of right turn movements from Princes Highway turning right into Oak Road from both north bound and south bound lanes is proposed (in addition to the current peak period ban in place) Alternative routes have been considered and the shortest alternative routes have been identified.

Pedestrian facilities including paths and signalised road crossings would potentially be impacted by the proposal. Potential impacts to pedestrians during construction would be managed through the development of a construction Traffic Management Plan (TMP).

The proposal would reduce congestion and improve travel times for vehicles travelling along the Princes Highway. With the implementation of the proposal, travel time improvements through the Princes Highway corridor in Kirrawee would be achieved of up to 12.6 kilometres per hour AM peak (south bound at Oak Road) and 20.7 kilometres per hour in the PM peak (south bound at Kingsway).

Noise and vibration
Receivers within close proximity of the Princes Highway already experience traffic background noise from existing traffic flows. During the construction phase of the proposal, work outside normal hours may be required to reduce disruptions to daily traffic and surrounding receivers. Residential, commercial and sensitive receivers near the proposal would potentially be impacted by construction activities. In particular, receivers located adjacent to the Princes Highway, Acacia Road, Oak Road, Kingsway and adjoining roads would be impacted most.

Affected sensitive receivers include residential, commercial and restaurants. Construction activities are anticipated to occur within 10 m of the most affected residential receivers, and within 15 m of some commercial receivers. Results indicate that noise levels would exceed NMLs for all construction scenarios in this area. No receivers would experience noise increases above 2dB as a result of the proposal. Activities occurring outside standard hours would also result in exceedances of NMLs at the nearest sensitive receivers. Safeguard measures have been proposed to mitigate noise impacts during construction.

Non-aboriginal heritage
The proposal would involve the removal of a mix of mature, adolescent and recently planted trees. These trees comprise the cluster of trees that form local heritage items
I3601 and I1509 under the Sutherland Shire LEP 2015. It has been identified that some of the trees within the heritage items are dated pre-1943 and are likely to date back to the 1930s depression relief schemes of the Sutherland Shire Council. Both item's aesthetic significance would be reduced by the removal of the trees.

Impact to heritage items I3601 and I1509 would be moderate to major and minor, respectively. Both items would retain significance at the local level, therefore delisting from the LEP would not result from the proposed works. To alleviate congestion issues and reduce journey time on the Princes Highway and Old Princes Highway, the removal of these trees would be required. Over time, the impact of the removal of these trees would be reversible, due to the opportunity for regrowth and the planting of new trees.

**Landscape character and visual impacts**

The various landscape character zones within the study area would be impacted by the proposal. The highest impact on character has been identified as moderate, due to the proximity of single-lot residential residents fronting the highway. The removal of trees and reduction in landscape service road verges increases the level of impact. The leafy character of the immediate area would be impacted by the proposal. Trees would be removed including those which form part of a heritage item, which contributes to the character of the broader area of Kirrawee.

Viewpoints across the proposal have also been identified, that are likely to be impacted. Six viewpoints were identified that reflect areas of key visual impacts from the proposal. Overall impact ratings for these viewpoints range from high to moderate to low, in respect to the viewers affected by the proposal. The western end of the project is most likely to experience the highest visual impacts. This is primarily due to the proximity of residential properties to the highway and vegetation removal.

Mitigation measures have been incorporated into the project to protect and enhance the existing visual character of the area and minimise impacts on neighbouring properties.

**Socioeconomic environment**

During the construction phase of the proposal, it is expected traffic delays would occur in response to changes in access and connectivity. Reduced speed limits around construction sites, increased heavy vehicle movements and detours would result in increased travel time for all road users. Residential properties between Auburn Street and Oak Road are likely to be most impacted by the proposal. As a result of the widening, changes to the service road would occur and properties would be closer to the road. Access into the service road from the Princes Highway would be removed at Kenneth Avenue and from the Oak Road intersection. Some properties would temporarily experience impacts to access during this time. It is likely that properties would be exposed to increased noise levels and dust from construction activities.

The majority of community facilities fall outside the project boundary and would not be directly impacted during the construction phase. Many of the businesses fronting onto the Princes Highway rely on visual exposure for business. During the construction phase, traffic delays and changes in access would potentially impact visibility. Local businesses would benefit from increased activity and expenditure is likely to have flow on effects to other businesses in the area.
During construction the community is likely to experience temporary traffic delays, noise, dust, visual and general amenity impacts. Measures have been proposed to address these temporary impacts.

The compound sites would impact the visual amenity of their surrounding residential areas for the duration of the construction phase. Views are not likely to be impacted by the use of these areas as compound sites. The increased presence of heavy vehicles entering and exiting the compound sites may contribute to traffic congestion in the immediate area.

The Sydney Water installation to the west end of the proposal would be separated from pedestrian traffic. The installation would be confined to an area within the grassed section of the carpark on the Old Princes Highway (approximately 70 metres east of the Merton Street) and would have limited to no impact on the socioeconomic environment.

**Other impacts**

Other impacts that have been considered and are discussed in this report include air quality, water quality, waste and Aboriginal heritage.

**Justification and conclusion**

The proposed upgrade of the Princes Highway at Acacia Road, Oak Road and Kingsway in Kirrawee is subject to assessment under Part 5 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.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment, including avoiding the need for private property acquisition.

The proposal as described in the REF best meets the project objectives but would still result in some impacts on heritage items of local significance, landscape (tree removal) and visual impacts. Safeguards and management measures as detailed in this REF would ameliorate or minimise these impacts. The proposal would also reduce congestion, improve travel reliability, support population growth and labour accessibility to key employment centres, improve road safety and improve freight efficiency. On balance the proposal is considered justified and the following conclusions are made.

**Display of the review of environmental factors**

This review of environmental factors is on display for comment between Monday 29 May and Monday 3 July 2017. Comments are to be provided by Monday 3 July 2017. You can access the documents in the following ways:

**Internet**


**Display**

The review documents can be viewed at the following locations:
• Sutherland Shire Council - 4/20 Eton St, Sutherland
• Miranda Library - 31 Wandella Rd, Miranda
• Sylvania Library - Southgate Shopping Centre, Port Hacking Rd, Sylvania
• Sutherland Library - 30-36 Belmont Street, Sutherland

How can I make a submission?
To make a submission on the proposal, please send your written comments to:
Gateway to the South Pinch Point Project Team
Roads and Maritime Services
PO Box 973
PARRAMATTA NSW 2124
Or email: G2S@mailto:@rms.nsw.gov.au
Submissions must be received by Monday 26 June.

Privacy information
All information included in submissions is collected for the sole purpose of assisting in the assessment of this proposal. The information may be used during the environmental impact assessment process by relevant Roads and Maritime Services staff and its contractors.

Where the respondent indicates at the time of supply of information that their submission should be kept confidential, Roads and Maritime will attempt to keep it confidential. However there may be legislative or legal justification for the release of the information, for example under the Government Information (Public Access) Act 2009 or under subpoena or statutory instrument.

The supply of this information is voluntary. Each respondent has free access at all times to the information provided by that respondent but not to any identifying information provided by other respondents if a respondent has indicated that the representation should be kept confidential.

Any respondent may make a correction to the information that they have provided by writing to the same address the submission was sent.

The information will be held by Roads and Maritime Services, 27-31 Argyle Street, Parramatta, NSW 2150.

What happens next?
Following the submissions period, Roads and Maritime will collate submissions. Acknowledgement letters will be sent to each respondent. The details of submission authors will be retained and authors will be subsequently advised when project information is released.

After consideration of community comments Roads and Maritime will determine whether the proposal should proceed as proposed, or whether any alterations to the proposal are
necessary. The community will be kept informed regarding this Roads and Maritime determination.

If the proposal goes ahead, Roads and Maritime proceeds with final design and tenders are called for construction of the project.

If you have any queries, please contact the Roads and Maritime Services project manager, Robin Ferdous on 02 8849 2374 or G2S@rms.nsw.gov.au.
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1 Introduction

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

1.1 Proposal identification

Roads and Maritime Services NSW (Roads and Maritime) proposes to upgrade the Princes Highway between Auburn Street and Kingsway in Kirrawee. The proposal involves the provision of additional lanes and new intersection configurations at Oak Road, Acacia Road and Kingsway, which would ease congestion and improve traffic flow along the corridor. This Review of Environmental Factors (REF) assesses the potential impacts of the proposal on the environment.

The Princes Highway connects the M1 Princes Motorway south of Waterfall to Sydney’s roads. It provides an important access route for traffic, including freight, between the south coast, Victoria and the Sydney CBD. This section of the Princes Highway considered by this proposal carries about 60,000 to 70,000 vehicles per day with heavy through movements at the Acacia Road and Oak Road intersections and a heavy right turn from the Princes Highway into Kingsway. Motorists using this section of the Princes Highway face congestion during morning and evening peak times.

The State Infrastructure Strategy highlights the government’s commitment to enhancing a Gateway to the South, which includes allocating $300 million to address pinch points across the A1 (Princes Highway), A3 (King Georges Road) and A6 (Heathcote Road) corridors. The proposal forms part of the Roads and Maritime Gateway to the South Pinch Points Program which aims to relieve traffic congestion and improve traffic flow on Sydney’s major southern corridors, including maximising capacity at key intersections. The proposal, as part of the pinch point program, includes maximising capacity at key intersections involving work such as lengthening or widening turn bays or implementing turn restrictions.

The proposal is located in the Sutherland Shire Local Government Area (LGA), approximately 29 kilometres from the Sydney Central Business District (CBD). The proposal extends from Kingsway in the east to Auburn Street in the west, covering a distance of approximately 1.25 kilometres on the Princes Highway. The section between Auburn Street and Acacia Road forms part of the Old Princes Highway. The proposal is located in a highly developed urban setting, with commercial and retail properties, residential properties and developments, car yards and building suppliers located along the Princes Highway. Construction of a residential development has commenced at a former brick pit site located at 566 Princes Highway (between Oak Road and Bath Road).

Local land use planning within the proposal is controlled through the Sutherland Shire Local Environmental Plan (LEP) 2015.

The location of the proposal is shown in Figure 1-1.
The proposal

LEGEND

- Proposal
- Construction impact area

Fig. 1.1
1.1.1 Key features of the proposal

To improve the operational efficiency of the Princes Highway, Roads and Maritime proposes upgrades and widening on the Princes Highway between Auburn Street and Kingsway to provide additional through lanes. The proposal would provide additional through lanes both north bound and south bound for the length of the proposal, and would tie into the existing three lane each way configuration at the proposal extents. The additional through lanes are achieved through road widening on the north bound side of the Princes Highway and upgrades to three major intersections.

Key features of the proposal would include:

- Upgrades to the Princes Highway and Acacia Road intersection
- Widening between Acacia Road and Oak Road on the northern side of the Princes Highway to provide a fourth south bound lane
- Closure of Kenneth Avenue access and exit to the Princes Highway
- Upgrade the service road between Acacia Road and Oak Road
- Upgrades to the Princes Highway and Oak Road intersection
- Permanent removal of right turn movements from Princes Highway turning into Oak Road (in addition to the current peak period ban in place)
- Upgrades to the Princes Highway and Kingsway intersection.

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

Subject to project approval, construction of the proposal would commence in November 2017 and be completed within 21 months.

Note, for the length of the proposal the Princes Highway runs in an east west direction (and vice versa). However, as the Princes Highway provides a north south link between Sydney and Wollongong, for the purposes of the REF through lanes travelling in a west direction are referred to as ‘south bound’, and through lanes travelling in an east direction are referred to as ‘north bound’ to better reflect the direction of travel within the Princes Highway corridor. Intersection approach descriptions remain aligned with the actual direction of travel at the intersection.

There are further capacity improvements and access works planned for the corridor along Princes Highway south bound and Oak Road, as part of the Deicorp south village development. Those further (developer funded) capacity improvements and access works can be constructed in isolation to the wider Roads and Maritime proposal listed above. These improvements are shown in Appendix C and are not being assessed in this REF. The developer’s works to Princes Highway are as follows:

- Left turn filter lane from Princes Highway south bound into the development site upstream of Oak Road
- Left turn filter lane into Oak Road from Princes Highway south bound
- Additional lane on Oak Road south on approach to Princes Highway.
1.2 Purpose of the report

This REF has been prepared by SMEC Australia Pty Ltd (SMEC) on behalf of Roads and Maritime Services Easing Sydney’s Congestion Program Office. For the purposes of these works, Roads and Maritime is the proponent and the determining authority under Part 5 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 protective measures to be implemented.

The description of the proposed work and associated environmental impacts have 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), the *Threatened Species Conservation Act 1995* (TSC 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 111 of the EP&A Act that Roads and Maritime examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Part 5.1 of the EP&A Act

- The significance of any impact on threatened species as defined by the TSC Act and/or FM Act, in section 5A of the EP&A Act and therefore the requirement for a Species Impact Statement

- The significance of any impact on nationally listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and whether offsets are required and able to be secured

- The potential for the proposal to significantly impact any other matters of national environmental significance or Commonwealth land and the need, subject to the EPBC Act strategic assessment approval, to make a referral to the Australian Government Department of the Environment for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.
2 Need and options considered

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

2.1 Strategic need for the proposal

The Princes Highway connects the M1 Princes Motorway south of Waterfall to Sydney’s roads. It provides an important access route for traffic, including freight, moving between the south coast and the Sydney CBD.

The Southern Sydney Access Strategy (SSAS), developed by TfNSW, initiated a program of work to improve access and travel times through the Southern Sydney region. The Princes Highway has been identified as one of the corridors south of the M5 Motorway containing pinch points which are currently causing congestion and affecting travel times through the region. Causes of congestion discussed in the SSAS for the proposal include:

- Heavy through movements at Princes Highway/ Acacia Road intersection
- Heavy through movements at Princes Highway/ Oak Road intersection
- The Kingsway intersection has an issue with heavy right turns from the Princes Highway into Kingsway.

The intersections within the proposal operate at a Level of Service (LoS) ranging from C to F in the AM peak and the PM peak, and the average delay times range from a maximum of 78.6 seconds in the PM peak and 51.8 seconds in the AM peak. These figures indicate motorists are currently experiencing delays due to traffic congestion while using this section of the Princes Highway in Kirrawee.

In a five year period between 2009 and 2014, 85 crashes were recorded at the Acacia Road intersection, 50 crashes at the Oak Road intersection and 19 crashes at the Kingsway intersection. Rear-end crashes represented the most dominant crash type along the proposal.

Other projects proposed by the Roads and Maritime to relieve congestion in the locality include:

- Upgrade of the Princes Highway/ The Boulevarde intersection
- Upgrade of the Princes Highway/ President Avenue intersection
- Clearways project on the south bound side of the Old Princes Highway between Acacia Road, Kirrawee and New Illawarra Road, Menai.

The proposal, on its own and collectively with the other projects listed above, is expected to assist in reducing congestion and improving travel time and access through Kirrawee, meeting the project objectives (refer section 2.3) and the objectives of the Gateway to the South Program (refer to Section 2.1.2).
2.1.1 NSW State Plan 2021

The NSW State Plan 2021 (State Plan) is the NSW Government’s 10 year plan which aims to increase patronage on public transport, improve efficiency of the road network, restore accountability of the government, achieve environmental economic benefits, build liveable centres, and involve the community in decision making on government policy, services and projects. The State Plan identifies 12 priorities identified by the state government, including building infrastructure.

The State Plan identifies the need for NSW to remain an appealing place that attracts talented people and businesses from around the globe. This requires smart, connected and resilient infrastructure.

The proposal is consistent with the aims of the State Plan by improving the efficiency on the road network through improved LoS at the upgraded intersections at Oak Road, Acacia Road and Kingsway, and the provision of additional through lanes on the Princes Highway between Auburn Street and Kingsway, connecting to the existing three lane configuration at each end of the proposal and removing the existing pinch point.

2.1.2 State Infrastructure Strategy 2012-32

The NSW State Infrastructure Strategy 2012-2032 (State Infrastructure Strategy) (Infrastructure NSW, 2012), released on 3 October 2012, is a 20 year strategy that identifies and prioritises the delivery of critical public infrastructure to drive productivity and economic growth.

The State Infrastructure Strategy details the government’s commitment to enhancing a Gateway to the South, including the allocation of $300 million to address pinch points across the A1 (Princes Highway), A3 (King Georges Road) and A6 (Heathcote Road) corridors. The Gateway to the South Pinch Points Program focuses on short to medium term solutions to reduce congestion and improve travel time and reliability for road traffic, including buses and freight.

The objectives of the Gateway to the South Pinch Points Program are to:

- Reduce congestion
- Improve travel reliability
- Support population growth and labour accessibility to key employment centres
- Improve road safety
- Improve freight efficiency.

The pinch point program includes maximising capacity at key intersections involving work such as lengthening or widening turn bays or implementing turn restrictions. More than 20 intersections have been identified for further investigation and potential upgrades, including the three intersections to be upgraded as part of this proposal.
2.1.3 **NSW Long Term Transport Master Plan**

The NSW Long Term Transport Master Plan (the LTTMP) outlines the NSW Government’s direction for transport planning and investment for the next 20 years. Its objectives focus on improving liveability and supporting economic growth and productivity. These objectives are to be facilitated by the provision of a transport network which reduces journey times, improves connectivity, increases efficiency and provides services that support job growth in centres close to where people live.

The LTTMP identifies that congestion is experienced across the road, rail and bus network across Sydney and can cost the economy around $5.1 billion annually. By doing nothing, Sydney cannot accommodate the increased demand on travel on the existing transport networks without generating more congestion, overcrowding along key corridors and longer travel times. As Sydney’s population and economy grows and changes, minimising congestion and boosting capacity on the most important transport corridors will become increasingly important.

The proposal aims to relieve congestion at pinch points identified along the Princes Highway in Kirrawee through improved LoS at the upgraded intersections within the proposal and the provision of additional through lanes on the Princes Highway between Auburn Street and Kingsway, connecting to the existing three lane configuration at each end of the proposal. The LoS of all three intersections and the delay times would improve as a result of the proposal, and this would improve travel conditions for motorists traveling through Kirrawee. This is consistent with the aims of the LTTMP.

2.1.4 **A Plan for Growing Sydney**

A Plan for Growing Sydney was released in December 2014. It is the NSW Government’s plan for the future of the Sydney Metropolitan Area over the next 20 years. It provides key directions and actions to guide Sydney’s productivity, environmental management, and liveability, including the delivery of housing, employment, infrastructure and open space.

The Plan identifies the government’s Pinch Point Program and states that it has been effective in targeting peak hour traffic hotspots and investigating ways to relieve traffic congestion. Removing “pinch points’ will benefit the efficiency of the freight network and productivity.

The proposal is consistent with this Plan, by aiming to relieve congestion and improve traffic flow along the Princes Highway at Kirrawee. The additional through lanes on the Princes Highway within the proposal and the upgrade of the Acacia Road, Oak Road and Kingsway intersections, the proposal would improve the LoS at each intersection and improve traffic flow through Kirrawee.

2.1.5 **Community Strategic Plan**

Sutherland Shire Council’s Community Strategic Plan titled ‘Our Shire, Our Future’ (Sutherland Shire Council, 2011) provides a road map for the long term planning for the Shire which will be used as a guide to shorter term planning and actions.

The Community Strategic Plan describes the Shire as a major thoroughfare for people travelling between Wollongong, the NSW south coast and Sydney centre, and states that providing an adequate level of transport infrastructure for the expected population growth in these areas will be critical to future planning of the Shire.
Of the six primary strategies identified in the Community Strategic Plan, the following strategy aligns with the objectives of this proposal:

- Provide effective and critical infrastructure – “construction and maintenance of critical infrastructure such as roads, footpaths and drains. Infrastructure which protects our environment and connects and strengthens our communities.”

The proposal would improve traffic efficiency between the NSW south coast and Sydney Centre, as well as for locals using the Princes Highway and the intersecting roads to reach destinations locally. The Community Strategic Plan is consistent with the objectives of this proposal.

2.2 Existing infrastructure

The proposal is located on the Princes Highway and a 150 metre section of the Old Princes Highway between Auburn Street and Acacia Road (refer to Figure 1-1).

For the length of the proposal, the Princes Highway is a six lane highway, with three lanes in each direction and additional turning lanes at Oak Road, Acacia Road and Kingsway intersections. The median varies between one and three metres, increasing to about seven metres near the Kingsway intersection.

Signalised intersections are provided at Acacia Road, Oak Road and Kingsway, including signalised pedestrian crossings at each intersection:

- Acacia Road intersection: A zebra crossing is provided at Acacia Road and at the left-turn lane from the Princes Highway to the Old Princes Highway south bound. A signalised pedestrian crossing provides access across the Princes Highway (south bound side of the Princes Highway)

- Oak Road intersection: A signalised pedestrian crossing is provided across Oak Road (on both the north bound and south bound sides of the Princes Highway) and across the Princes Highway (on the western side of the intersection)

- Kingsway intersection: Pedestrians can cross Kingsway via a zebra crossing provided at the left turn lane from Kingsway to the Princes Highway south bound. From here, pedestrians can continue to cross Kingsway via a signalised crossing. There is no signalised crossing across the Princes Highway at this location.

The speed limit along the Princes Highway is 70 kilometres per hour. Local roads intersecting the proposal have a speed limit of 50 kilometres per hour. The Princes Highway operates under clearway conditions, both north bound and south bound, between:

- 6am and 10am, 3pm and 7pm Monday to Friday
- 10am to 7pm Saturday and Sunday

The Princes Highway south bound is also no parking outside of clearway hours.
2.2.1 Auburn Street to Acacia Road
An existing two metre footpath is provided along the Old Princes Highway between Auburn Street and Acacia Road. Established trees and recent plantings with protective fencing are located along the vegetation strip between Auburn Street and Acacia Road. There are no safety barriers along this section of the road.

A left turn only movement is currently provided from the Old Princes Highway into Acacia Road. There is no direct access onto the Princes Highway from Acacia Road.

The lane configurations at the Princes Highway/Acacia Road/Old Princes Highway intersection are:

- Two south bound through lanes on the Old Princes Highway / Princes Highway. One ‘bus only’ south bound lane on approach to the intersection
- Three north bound through lanes on the Princes Highway / Old Princes Highway
- Three right-turn lanes from the Princes Highway/Acacia Road onto the Princes Highway north bound
- One left-turn lane from the Princes Highway/Acacia Road onto the Old Princes Highway south bound
- Two left-turn lanes from the Princes Highway south bound to the Princes Highway/Acacia Road south bound.

2.2.2 Acacia Road to Oak Road
An existing service road is located between Acacia Road and Oak Road which is used by pedestrians as a continuation of the footpath as well as motorists accessing residential properties along this section of the Princes Highway. The service road is currently separated from the Princes Highway by a batter.

Access into and out of the service road from the Princes Highway is blocked at the Oak Road intersection. Access is provided via Kenneth Avenue and Gilmore Avenue from the north.

The lane configurations at the Princes Highway/Oak Road intersection are:

- Three north bound through lanes on the Princes Highway, and one right turn lane from the Princes Highway north bound to Oak Road (southern approach). The right turn is permitted during off-peak times
- Three south bound through lanes on the Princes Highway, and one right turn lane from the Princes Highway south bound to Oak Road (northern approach). The right turn is permitted during off-peak times
- One shared through and left turn lane onto the Princes Highway for vehicles heading south bound and one shared through and right turn lane for vehicles heading north bound on Oak Road (southern approach)
- One dedicated right turn lane into the Princes Highway for vehicles heading south bound from Oak Road (northern approach) and one shared through and left turn lane onto the Princes Highway for vehicles heading north bound.
Acacia Road intersection existing lane configuration

Fig. 2.2

Vector backdrop data © MIDS 2017, public_NSW_Imagery: © Land and Property Information 2015

Last updated by: DW13219 on 15/05/2017 at 10:23
Acacia Road to Oak Road existing lane configuration

Fig. 2.3
Turning restrictions

Turning restrictions are in place at the Oak Road intersection for north bound and south bound traffic. The right turn from Princes Highway north bound into Oak Road is currently restricted during peak hours. The right turn from Princes Highway south bound into Oak Road is also restricted during peak hours. Both right turn movements are currently permitted during off-peak times.

2.2.3 Oak Road to Kingsway

An existing two metre footpath is provided from Oak Road to Kingsway. The footpath is temporarily occupied in sections by construction works. The roadside verge at this location is an open area with mature trees and recent plantings.

A slip lane provides access from the Princes Highway to the Kirrawee McDonalds. A service road on the north bound side of the Princes Highway opposite the Kingsway intersection provides access to car yards and other retailers.

The lane configurations at the Princes Highway/Kingsway intersection are:
- Three north bound through lanes on the Princes Highway
- Two right turn lanes from the Princes Highway into Kingsway
- Three south bound through lanes on the Princes Highway
- One short left turn lane from the Princes Highway south bound into Kingsway

Parking restrictions

There is an existing ‘No Stopping’ zone along Kingsway eastbound for about 70 metres from Princes Highway. There is an additional ‘No Stopping’ zone beginning 40 metres from Hotham Road, ending at Hotham Road.

In accordance with NSW road rules, vehicles are prohibited from stopping within 10 metres of the intersection of Kingsway with Foch Avenue. They are also prohibited from stopping on or within 20 metres before a bus stop.

In addition, there are existing ‘No Stopping’ and ‘No Parking’ zones at the intersection of Foch Avenue with the local access road running along Kingsway eastbound.

There are currently no parking restrictions on Foch Avenue and Hotham Road.
Oak Road intersection existing lane configuration

Fig. 2.4

Vector backdrop data © MDS 2017, public_NSW_Imagery: © Land and Property Information 2015

Last updated by: DW13219 on 15/05/2017 at 10:24
Oak Road to Kingsway existing lane configuration

Fig. 2.5

Vector backdrop data © MDS 2017, public_NSW_Imagery: © Land and Property Information 2015

Last updated by: DW13219 on 15/05/2017 at 10:24
2.2.4 Utilities
The following service providers have utilities along the proposal:

- Sydney Water
- Ausgrid
- Telstra
- ITS Traffic Systems.

Further detail is provided in Section 3.4.

2.2.5 Public transport – bus services, bus stops

Bus route numbers 961, 962, 963, 974, 976 and 989 pass through the proposal travelling in both north bound and south bound directions. These buses are operated by Transdev. Figure 2-1 and Figure 2-2 illustrate the routes through and around the proposal. There are no bus stops located within the proposal area.

More than 10 bus routes travel in close proximity to the proposed compound sites, including Route 7 and Route 972 at Wandella Road/The Boulevarde compound site, and more than 10 routes at the Sylvania Road/Kingsway compound site. These routes are displayed in Figure 2-8.

Kirrawee railway station is located on Oak Road about 300 metres to the south of the intersection with the Princes Highway.

2.2.6 Drainage infrastructure

Existing pavement drainage along the Princes Highway consists of pits, pipes and kerb gutters. The existing drainage generally falls towards the kerb and in some locations drains towards the centre median. Figure 2-9 shows the existing drainage infrastructure across the proposal.
Bus routes
2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

The key objectives of the proposal are consistent with the objectives of the Gateway to the South Pinch Points Program (refer to Section 2.1.2), and include:

- Objective 1 - Improve the operational efficiency, ease traffic congestion and improve consistency of travel times for motorists on the Princes Highway corridor, specifically the Acacia Road, Oak Road and Kingsway intersections
- Objective 2 - Improve traffic flow whilst maximising use of road space
- Objective 3 - Improve road safety and minimise non-recurrent congestion events
- Objective 4 - To deliver a value-for-money solution and deliver a positive benefit-cost ratio.
- Objective 5 - Minimise impacts to land use and the community, including requirements for property acquisition and utility adjustments.
- Objective 6 - Minimise impacts to the local environment including adjacent bushland, whilst enhancing urban design and transport outcomes.

2.4 Alternatives and options considered

2.4.1 Methodology for selection of preferred option

The development process for the proposal involved an iterative method of investigation, identification, evaluation and refinement of road improvement options (for example widening) within and immediately adjacent to the existing Princes Highway corridor.

During the strategic design development stage, preliminary options were investigated by Roads and Maritime for each of the three intersections in the proposal area. These options included:

- Utilising the bus jump start lane and median modification to provide an additional through lane at the intersection of Acacia Road
- Tidal flow configuration at the Oak Road intersection utilising the existing right turn bays into through traffic lanes
- Widening on the southern side of the Princes Highway to create additional through traffic lanes
- Reconstruction of a new median near the Kingsway and altering the turn lanes into and out of the Kingsway for an additional through lane on the Princes Highway

These options were assessed for constructability, design complexities, environmental and community constraints, property acquisition, utility impacts and traffic performance.

Following this, Roads and Maritime developed two options – a “do nothing” option or an “upgrade” option which incorporated favourable components from the strategic design options.

Two upgrade options were considered, both options included upgrades and widening along the existing road alignment, as described in Section 2.4.2. The advantages and disadvantages of each option are discussed in Section 2.4.3.
The preferred option was selected based on an evaluation of the identified options (including the ‘do nothing’ option) against the proposal objectives. It included consideration of design, congestion / delays (measured by reference to LoS), land use and community impact including property acquisition requirements, economic performance (benefit-cost ratio) and minimising environmental impacts.

The benefit-cost ratio is calculated by dividing the value of benefits by the value of costs. For road projects, benefits usually include the value of travel time savings (both private and commercial), vehicle operating cost savings, road safety benefits and environmental benefits. Costs refer to initial capital investment and life cycle road maintenance costs.

2.4.2 Identified options

During the development of the proposal, three options were considered:

- A base case, or ‘do-nothing’
- Upgrade Option 1 - upgrade and widening along the existing road alignment including a dual left-out of Kingsway to Princes Highway south bound
- Upgrade Option 2 - upgrade and widening along the existing road alignment, retaining the existing single left-out of Kingsway to Princes Highway south bound.

Do-nothing option

A theoretical base case or ‘do nothing’ option would involve no upgrade to the existing Princes Highway alignment. It assumes only ongoing maintenance of the existing road.

Option 1

To improve the operational efficiency of the Princes Highway and the three intersections within the proposal, the design proposes additional through lanes to provide four lanes both north bound and south bound for the length of the proposal (refer to Figure 2-10). In addition to providing additional through lanes, Option 1 considered the following intersection arrangements:

- Acacia Road intersection
  - Additional north bound right turn lane on Princes Highway at Acacia Road
- Widening between Acacia Road and Oak Road on the northern side of the Princes Highway to provide a fourth south bound lane, including:
  - Closure of Kenneth Avenue access to and from Princes Highway.
  - Upgrade the service road between Acacia Road and Oak Road
- Oak Road intersection
  - Provision of additional north bound and south bound through lanes accommodated through the removal of right turn lanes from Princes Highway to Oak Road
  - Dedicated shared left and through lane into Oak Road from Princes Highway
  - Widening on the northern side of Princes Highway to provide an additional through lane
  - A new slip lane into McDonalds Kirrawee
- Kingsway intersection
- Additional north bound right turn lane from Princes Highway to Kingsway
- Lengthened left turn filter lane from Princes Highway south bound to Kingsway.
- Additional left-out lane to provide dual left-out of Kingsway to Princes Highway south bound.

Option 2
To improve the operational efficiency of the Princes Highway and the three intersections within the proposal, the design proposes additional through lanes to provide four lanes both north bound and south bound for the length of the proposal (Figure 2-11). In addition to providing additional through lanes, Option 2 considered the following intersection arrangements:

- Acacia Road intersection
  - Additional north bound right turn lane on Princes Highway at Acacia Road
- Widening between Acacia Road and Oak Road on the northern side of the Princes Highway to provide a fourth south bound lane, including:
  - Closure of Kenneth Avenue access to and from Princes Highway.
  - Upgrade the service road between Acacia Road and Oak Road
- Oak Road intersection
  - Provision of additional north bound and south bound through lanes accommodated through the removal of right turn lanes from Princes Highway to Oak Road
  - Dedicated shared left and through lane into Oak Road from Princes Highway
  - Widening on the northern side of Princes Highway to provide an additional through lane
  - Provision of a slip lane into McDonalds Kirrawee
- Kingsway intersection
  - Additional north bound right turn lane from Princes Highway to Kingsway
  - Lengthened left turn filter lane from Princes Highway south bound to Kingsway.
  - Retain existing single (one lane) left-out of Kingsway to Princes Highway south bound.

2.4.3 Analysis of option

Base Case (‘do nothing’)
The Princes Highway at Kirrawee carries between 60,000 and 70,000 vehicles per day in both directions, including heavy vehicles and is a strategic transport link between Sydney, Wollongong and Victoria. Motorists using the Princes Highway at Kirrawee experience delays due to congestion. The Kingsway intersection performs at a LoS of F in the PM peak and the Acacia Road intersection perform at a LoS of F in the AM peak.

The ‘do nothing’ option would not provide a solution to improve the existing congestion at intersections, nor would this option address urban growth in the region. Increasing delays along the Princes Highway would continue to affect freight transport and general
traffic. As such, the do nothing option does not address the traffic flow and operational efficiencies targeted by the proposal (Objective 1 and Objective 2).

The ‘do nothing’ option would not improve safety (Objective 3) as continued congestion at LoS F and increased urban growth in the region would result in increased non-recurrent congestion events.

While the ‘do nothing’ option would have lower construction impacts on the natural environment as minimal works would be undertaken (proposal Objective 6), the Princes Highway would experience an increase in operational impacts such as increased noise and air quality impacts resulting from congestion, queueing and engine idle time.

The ‘do-nothing’ option does not meet the objectives of the proposal and is therefore not considered a feasible alternative.

**Option 1**

Option 1 largely provides the same key project elements as Option 2, with the exception of a dual left-turn lane being proposed in Option 1 (refer to Section 2.4.2). When considered against the proposal objectives (refer to Section 2.3), Option 1:

- Supports Objective 1 (improved operational efficiency) along the Princes Highway through the provision of an additional through lane (providing four lanes) in both north bound and south bound directions. Objective 1 is supported by the modelled improvements to LoS and travel time at the three intersections:
  - Acacia Road intersection - Improves overall intersection LoS in the 2025 PM peak from LoS F to LoS C
  - Oak Road intersection - Improves overall intersection LoS in the 2025 PM peak from LoS D to LoS C
  - Kingsway intersection - Improves overall intersection LoS in the 2025 PM peak from LoS F to LoS C
  - Princes Highway - Improves overall average vehicle speed in the 2025 PM Peak from 11.8 kilometres per hour to 31.6 kilometres per hour

- Supports Objective 2 (maximise use of road space) by accommodating additional through lanes at Oak Road through the removal of right turn lanes from Princes Highway to Oak Road, and minimising road widening impacts by widening only on the northern side of the Princes Highway.

- Supports Objective 3 (improve safety and minimise non-recurrent congestion events) through the provision of additional through lanes in both directions, and LoS improvements at each intersection, improving traffic flow and reducing risk of rear-end crashes (refer to Section 2.1)

- Road widening to accommodate a dual left-turn lane on Kingsway (to Princes Highway south bound ) would require partial property acquisition of around five properties. As such Option 1 is not the preferred option in support of Objective 4 (minimise land use and community impacts).

- Property acquisition would result in a reduced benefit-cost ratio (Objective 5) than options to avoid acquisition (Option 2).

- Supports Objective 6 (reducing environmental impact) through maximising design elements within previously disturbed areas of the road corridor (for example, utilising
road space from the existing turning lanes at Oak Road), minimising widening to a single side of the existing road verges and vegetated areas, and through minimising requirements for property acquisition, thereby reducing impacts to the environment.

**Option 2**

Similar to Option 1, Option 2 largely provides the same key project elements along the Princes Highway and at the three intersections as Option 1 (refer to Section 2.4.2). Under Option 2, the existing single left-turn lane from Kingsway to Princes Highway south bound is retained.

When considered against the proposal objectives (refer to Section 2.3), Option 2:

- Supports Objective 1 (improved operational efficiency) along the Princes Highway through the provision of an additional through lane (providing four lanes) in both north bound and south bound directions. Objective 1 is supported by the modelled improvements to LoS and travel time at the three intersections:
  - Acacia Road intersection - Improves overall intersection LoS in the 2025 PM peak from LoS F to LoS C
  - Oak Road intersection - Improves overall intersection LoS in the 2025 PM peak from LoS F to LoS C
  - Kingsway intersection - Improves overall intersection LoS in the 2025 PM peak from LoS F to LoS C
  - Princes Highway - Improves overall average vehicle speed through the Oak Road intersection in the 2025 PM Peak from 25.7 kilometres per hour to 32.8 kilometres per hour
- Supports Objective 2 (maximise use of road space) by accommodating additional through lanes at Oak Road through the removal of right turn lanes from Princes Highway to Oak Road, and minimising road widening impacts to private properties by widening only on the northern side of the Princes Highway.
- Supports Objective 3 (improve safety and minimise non-recurrent congestion events) through the provision of additional through lanes in both directions, and LoS improvements at each intersection, improving traffic flow and reducing risk of rear-end crashes (refer to Section 2.1)
- Supports Objective 4 (minimise land use and community impacts) as property acquisition would not be required on the western side of the road bend on Kingsway, reducing impacts to land use and the community at this location
- Supports Objective 5 (value-for-money solution) through reduced property acquisition requirements to that of Option 2, providing an improved benefit-cost ratio.
- Supports Objective 6 (reducing environmental impact) through the provision of additional lanes using existing road space (turning lanes at Oak Road), minimising widening into the existing road verges, and minimising property acquisition. The preferred option limits impacts to the environment meeting proposal Objective 6.
2.5 Preferred option

The preferred option is option 2, an upgrade and widening of Princes Highway to four lanes in each direction between Auburn Street and Kingsway at Kirrawee. The option includes upgrades to three intersections along the Princes Highway including Acacia Road, Oak Road and Kingsway.

The preferred option directly addresses the NSW Government’s strategic goals, priorities and actions as outlined in the *NSW State Infrastructure Strategy 2012-2032* (State Infrastructure Strategy) (Infrastructure NSW, 2012). The State Infrastructure Strategy details the government’s commitment to enhancing a Gateway to the South. The Gateway to the South Pinch Points Program focuses on short to medium term solutions to reduce congestion and improve travel time and reliability for all road traffic, including buses and freight.

The preferred option would best meet the proposal objectives by:

- Supports Objective 1 (improved operational efficiency) along the Princes Highway through the provision of an additional through lane (providing four lanes) in both north bound and south bound directions. Objective 1 is supported by the modelled improvements to LoS and travel time at the three intersections.

- Supports Objective 2 (maximise use of road space) by accommodating additional through lanes at Oak Road through the removal of right turn lanes from Princes Highway to Oak Road, and minimising road widening impacts by widening only on the northern side of the Princes Highway.

- Supports Objective 3 (improve safety and minimise non-recurrent congestion events) through the provision of additional through lanes in both directions, and LoS improvements at each intersection, improving traffic flow and reducing risk of rear-end crashes.

- Supports Objective 4 (minimise land use and community impacts) as property acquisition would not be required on the western side of the road bend on Kingsway, reducing impacts to land use and the community at this location.

- Supports Objective 5 (value-for-money solution) through reduced property acquisition requirements to that of Option 1, providing an improved benefit-cost ratio.

- Supports Objective 6 (reducing environmental impact) through the provision of additional lanes using existing road space (turning lanes at Oak Road), minimising widening into the existing road verges, and minimising property acquisition. The preferred option limits impacts to the environment meeting proposal Objective 6.
Option 1

Dual left turn onto Princes Highway

LEGEND

Option 1 road design (RMS supplied)
Option 2
Retain existing single left turn onto Princes Highway
3 Description of the proposal

This chapter describes the proposal and provides descriptions of existing conditions, the design parameters including major design features, the construction method and associated infrastructure and activities. The description of the proposal is based on the concept design and is subject to further refinement during detailed design.

3.1 The proposal

To improve the operational efficiency of the Princes Highway, Roads and Maritime proposes upgrades and widening on the Princes Highway between Auburn Street and Kingsway to provide additional through lanes. The proposal would provide additional lanes both north bound and south bound for the length of the proposal, and would tie into the existing three lane each way configuration at the proposal extents. The additional through lanes are achieved through road widening on the north bound side of the Princes Highway and upgrades to three major intersections. The proposal is shown in Figures 3-1 to 3-6.

Key features of the proposal include:

- Upgrades to the Princes Highway and Acacia Road intersection
- Widening between Acacia Road and Oak Road on the northern side of the Princes Highway to provide a fourth south bound lane
- Closure of Kenneth Avenue access and exit to the Princess Highway
- Upgrade the service road between Acacia Road and Oak Road
- Upgrades to the Princess Highway and Oak Road
- Permanent removal of right turn movements from Princes Highway turning into Oak Road (in addition to the current peak period ban in place)
- Upgrades to the Princes Highway and Kingsway intersection.

The following sections outline more detail about the intersection upgrades.

Auburn Street intersection

The upgrade of the Auburn Street intersection with the Old Princes Highway (refer Figure 3-1) includes:

- Remove part of the existing median island on the Old Princes Highway near Auburn Street to provide a third north bound through lane, where there is currently only two lanes
- Provision of a retaining wall with a concrete barrier up to a height of 1 metre along the Old Princes Highway in front of the vacant land at 642 Princes Highway (next to the Bupa Aged Care Home), up to Acacia Road North. This retaining wall will run for a length of 40 metres.

The proposed operational layout of Auburn Street is illustrated in Figure 3-1.
Acacia Road intersection
The upgrade of the Acacia Road intersection with the Old Princes Highway and Princes Highway (refer Figure 3-2) includes:

- Modification to the traffic island at Acacia Road North (maintaining existing left in only movements from Old Princes Highway)
- Additional north bound right turn lane on Princes Highway/Acacia Road, making this a dual right turn movement
- Reducing the existing short bus lane into a bus jump lane at Acacia Road intersection
- Widening on the northern side of the Princes Highway, up to a maximum of 6 metres varying along the length, to provide an additional south bound through lane on Princes Highway making it three lanes where there is currently only two lanes
- Provision of a retaining wall with a concrete barrier up to a height of 2.2 metres along the Princes Highway starting at Acacia Road North and extending up to Oak Road (full length of about 415 metres).

The proposed operational layout of the Princes Highway and Acacia Road intersection is illustrated in Figure 3-2.

Acacia Road to Oak Road
The upgrade of the Princess Highway between Acacia Road and Oak Road (refer to Figure 3-3) includes:

- Widening between Acacia Road and Oak Road on the northern side of the Princes Highway up to a maximum of 7.5 metres varying along the length, to provide a fourth south bound through lane, from the current three lanes
- Closure of Kenneth Avenue access and exit to the Princes Highway
- Provision of a retaining wall with a concrete barrier up to a height of 2.2 metres along the Princes Highway starting at Acacia Road North and extending up to Oak Road (full length of about 415 metres)
- Upgrade the service road between Acacia Road and Oak Road:
  - Provide landscaping along the service road including vegetation plantings and urban design features on the retaining wall facing the residential properties
  - Provide indented car parking bays along the service road with landscaped garden beds
  - Access to the service road from Kenneth Avenue would continue to be available

The proposed operational layout from Acacia Road to Oak Road is illustrated in Figure 3-3.
Additional north bound right turn lane on Princes Highway

Provision of third north bound lane

New retaining wall

Additional north bound right turn lane on Princes Highway

LEGEND

- Retaining wall
- Proposal

Key features of the proposal - Auburn Street to Acacia Road

Fig. 3.1
Additional north bound right turn lane on Princes Highway

Provision of third north bound lane

Additional south bound through lane on Princes Highway

New retaining wall

Indented car parking bays

Key features of the proposal - Acacia Road intersection

LEGEND
- Proposal
- Retaining wall
- Indented car parking bays

Fig. 3.2
Slip lane into Acacia Road

Closure of Kenneth Avenue access to and from Princes Highway

Upgrade service road between Acacia Road and Oak Road including shared path, indented car parking bays, retaining wall and landscaping

Widening to provide fourth south bound lane

New retaining wall

Indented car parking bays

Key features of the proposal - Acacia Road to Oak Road
Oak Road intersection
The upgrade of the Princes Highway at the Oak Road intersection (refer Figure 3-4) includes:

- Permanent removal of right turn movements from Princes Highway turning into Oak Road (in addition to the current peak period ban in place) for both south bound and north bound traffic on the Princes Highway
- Provision of additional north and south bound through lanes on the Princes Highway accommodated through the removal of right turn lanes from Princes Highway to Oak Road
- Dedicated shared left and through lane into Oak Road from Princes Highway north bound
- End and tie in of the retaining wall along the service road at Oak Road
- Widening on Oak Road (northern approach) to create a dedicated left turn lane, through lane, and dedicated right turn lane from the existing two lane arrangement
- Installation of a new pedestrian footpath on the eastern side of Oak Road (north approach) with removal of the grass verge due to the widening
- New pedestrian crossing on the eastern approach of the intersection, across the Princes Highway. This will result in pedestrian crossings on all approaches at the intersection.

The proposed operational layout of the Oak Road intersection is illustrated in Figure 3-4.

Oak Road to Kingsway
The upgrade of the Princes Highway between Oak Road and Kingsway (refer Figure 3-4 and Figure 3-5) includes:

- Widening between Oak Road and Kingsway on the northern side of the Princes Highway up to a maximum of 10 metres varying along the length, to provide a fourth northbound road to Bath Road
- The widening on the northern side of the Princes Highway will also provide a fourth south bound lane from about 200 metres south of Bath Road to the Acacia Road intersection
- Upgraded and lengthened slip lane into McDonalds Kirrawee and adjacent businesses with direct access from the Princes Highway.

The proposed operational layout from Oak Road to Kingsway is illustrated in Figure 3-4 and Figure 3-5.

Kingsway intersection
The upgrade of the Princes Highway and the Kingsway intersection (refer Figure 3-6) includes:

- Widening in the northern side of the Princes Highway to provide an additional north bound right turn lane from Princes Highway to Kingsway, making it a triple right turn movement from the existing dual right turn
• Widening in the southern side of the Princes Highway from about 100 metres north of Kingsway to provide a lengthened left turn filter lane from Princes Highway south bound to Kingsway

• New pedestrian crossing at the Kingsway intersection, across the Princes Highway, where there is currently no pedestrian crossing facilities. The existing crossing across the Kingsway will be maintained

• Maintain the existing service road entry and direct access for businesses from the Princes Highway at the Kingsway (northern side)

• Installing formal No Parking signage for a total length of 76 metres on the Kingsway (eastbound) about 70 metres from the Princes Highway. This section currently has section of No Stopping, No Parking and Bus Stopping clear zone. This length of No Parking will result in about 12 car spaces to be removed.

The proposed operational layout of the Kingsway intersection is illustrated in Figure 3-6.

In addition to the above physical traffic capacity enhancements, the following local enhancements are proposed for non-motorised trips and amenity:

• Enhanced pedestrian crossing facilities at the intersections; including an additional pedestrian crossing across the Princes Highway at Oak Road on the eastern side and a staggered pedestrian crossing across the Princes Highway at Kingsway on the eastern side.

• Enhanced local service road parallel to Princes Highway between Acacia Road and Oak Road.
Closure of Kenneth Avenue access to and from Princes Highway

Permanent removal of right turn movements from Princes Highway to Oak Road

Upgraded slip lane into McDonald's

Enhanced pedestrian crossing facilities including additional crossing on Oak Road and Princes Highway (eastern side)

Provisional of additional north bound and south bound lane

New retaining wall

LEGEND

Proposal

Retaining wall

Key features of the proposal - Oak Road intersection

Fig. 3.4
Upgraded slip lane into McDonald's

Provisional of additional eastbound and westbound lane

Provisional of additional north bound and south bound lane

LEGEND

Proposal

Key features of the proposal - Oak Road to Kingsway

Fig. 3.5

Vector backdrop data © MDS 2017, public_NSW_Imagery: © Land and Property Information 2015

Last updated by: DW13219 on 15/05/2017 at 11:22
Additional north bound right turn lane from Princes Highway to Kingsway

Additional left turn filter lane from Princes Highway to Kingsway

Staggered pedestrian crossing across the Princes Highway at Kingsway (eastern side)
Other activities associated with the proposal include:

- Utilities relocation and adjustments are also proposed, in order to construct the above works
- Adjustments to driveway entrances along the length of the realigned service road (from Acacia Road to Oak Road) and commercial and retail properties from Oak Road to the Kingsway intersection
- Installation of formalised kerbs, pram ramps, minor footpath modifications
- Provide new line marking and signage
- Realignment of the existing VMS sign in front of the McDonalds to the edge of the new kerb
- Provide new pavement and re-asphalt
- Landscaping
- Urban design on the retaining wall along the service road
- Temporary infrastructure to allow project works including site compounds, sedimentation and erosion control, stockpiling sites and other infrastructure as required.

There are further capacity improvements and access works planned for the corridor along Princes Highway south bound and Oak Road, as part of the Deicorp south village development. Those further (developer funded) capacity improvements and access works can be constructed in isolation to the wider Roads and Maritime proposal listed above. These improvements are shown in Appendix C and are not being assessed in this REF. The developer’s works to Princes Highway are as follows:

- Left turn filter lane from Princes Highway south bound into the development site upstream of Oak Road
- Left turn filter lane into Oak Road from Princes Highway south bound
- Additional lane on Oak Road south on approach to Princes Highway.

Alternative Traffic Routes addressing the proposed ban of right turns from Princes Highway to Oak Road and the proposed closing of Kenneth Avenue at Princes Highway is provided in Section 6.1.

Subject to project approval, construction of the proposal would commence in November 2017 and be completed within 21 months.
3.2 Design

3.2.1 Design criteria

The proposal was designed to be consistent with Roads and Maritime design criteria and other specifications including requirements of this document. Key reference documentation is the Roads and Maritime updates issued for use in conjunction with the Guide to Road Design (Austroads, 2009).

The design criteria for the proposal include those identified in Table 3-1.

Table 3-1 Design criteria for the proposal

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Design criteria</th>
</tr>
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<tr>
<td>Design speed</td>
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<tr>
<td>Posted speed</td>
<td>70 kilometres per hour</td>
</tr>
<tr>
<td>Stopping sight distance</td>
<td>110 metres</td>
</tr>
<tr>
<td>Horizontal radius</td>
<td>265 metres</td>
</tr>
<tr>
<td>Superelevation</td>
<td>5%</td>
</tr>
<tr>
<td>Drainage</td>
<td>3% cross fall</td>
</tr>
<tr>
<td></td>
<td>Piped network: 10yr ARI</td>
</tr>
<tr>
<td></td>
<td>Overland flow :100 yr ARI</td>
</tr>
<tr>
<td>Grade</td>
<td>0.5% to 6%</td>
</tr>
<tr>
<td>Lane width</td>
<td>3.0 to 3.3 metres</td>
</tr>
<tr>
<td>Verge width</td>
<td>2.4 metres</td>
</tr>
<tr>
<td>Median width</td>
<td>1.2 metres</td>
</tr>
<tr>
<td>Footway width</td>
<td>2.4 to 4.5 metres</td>
</tr>
<tr>
<td>Design vehicle</td>
<td>B-double</td>
</tr>
</tbody>
</table>

3.2.2 Urban design objectives

The urban design objectives of the proposal are to:

- To provide continuous ‘green’ corridor wherever possible, to maintain the character of the area and to improve character of the highway
- Deliver an integrated approach to traffic (including pedestrian and cycle), public transport and land use
- Retain the privacy and amenity of residents in the local streets in the immediate area
- Design integrated urban infrastructure elements that allow the landscape to dominate and built forms to recede.
3.2.3 Engineering constraints

The engineering constraints which have influenced the development of the concept design include:

- Existing service road along the northern side of the Princes Highway between Acacia Road and Oak Road
- Trees on the northern side of the Princes Highway between Auburn Street and Oak Road
- Property access from the service road during construction and utility relocation
- Commercial and residential developments on either side of the Princes Highway including the residential development under construction at the former brickpit site at the intersection with Oak Road
- Existing underground utilities (refer to Section 3.5).

3.2.4 Traffic typical cross-sections

Figure 3-7 and Figure 3-8 illustrate two draft typical cross-sections across the proposal which are currently under detailed design.

Figure 3-7 Urban design visualisation cross section between Acacia Road and Oak Road

As shown in Figure 3-7, this urban design visualisation cross section shows the Princes Highway between Acacia Road and Oak Road. The retaining wall has been proposed with a concrete barrier on the kerbside lane and a corridor for utilities on the other side of the barrier with some space for landscaping.
Typical draft design cross-section of the Princes Highway between Acacia Road and Oak Road

Fig. 3.7
3.3 Construction activities

3.3.1 Work methodology

The methods used to construct the proposal would be conventional techniques employed on road projects, adapted to account for project-specific environmental and social constraints. Figure 3-9 to Figure 3-15 illustrate the construction impact area as assessed in this REF. While the detailed construction methodology is yet to be confirmed, the sequence of works would be as follows:

- Site establishment at compound area including:
  - Set-up of site offices, laydown area and material stockpile sites.
  - Secure site with installation of fencing.

- Pre-construction works would commence including:
  - Surveying
  - Potholing and location of underground utilities

Sydney water pipeline adjustment works would commence and be staged as follows:

- Stage 1
  - Installation of a new 600mm nominal diameter isolation valve at the grassed area off the 685 Old Princes Highway, Kirrawee
  - About 90m of adjustment of a 200mm nominal diameter main at Kingsway.
  - Provide a temporary connection between the 375mm and 500mm nominal diameter water mains near Bath Road.

- Stage 2
  - About 1km of removal and replacement of 375mm and 500mm nominal diameter water mains with a single 750mm nominal diameter between Acacia Road and Bath Road.
  - About 130m of adjustment of a 200mm nominal diameter main at Kingsway between Acacia Road and Bath Road.

- Stage 3
  - About 500m of adjustment of a 750mm nominal diameter main in the service road between Acacia Road and Oak Road.

The proposed water main adjustments would be constructed using an open trenching technique, with a trench depth of three metres or less.

Construction activities associated with trenching include:

- Site preparation.
- Establishing temporary construction compounds at appropriate locations along the pipeline route.
- Establishing erosion and sediment control measures.
- Vegetation removal.
• Providing temporary access to properties where trench routes impact driveways.
• Trench excavation, stockpiling of spoil material on the upslope side of trenches.
• Shoring and dewatering of trenches, depending upon trench depth and groundwater levels.
• Spreading of granular material such as sand or gravel along the bottom of the trench prior to laying.
• Installing pipeline.
• Backfilling the trench with bedding material and excavated soil.
• Compacting trench fill material.
• Testing and commissioning pipeline, implementing traffic management measures.
• Site reinstatement.

For the installation of the 600mm nominal diameter valve, the following additional works are expected:
• Barricade the area including occupying up to four car spaces for the period of works.
• Excavate to the pipe - up to two metres wide, five metres long and three metre deep trench.
• Isolate the main and drain the water out in a five to eight hour shut down (one night).
• Installation of a 600mm nominal diameter valve and one hydrant on either side of the valve. The valve and hydrant will be enclosed in three 1m wide and 1m long precast pits.
• Backfill the trench and dispose of excess spoil.
• Demobilise.

Roadworks would commence in tandem with the proposed water pipeline adjustment works, where possible, and will be staged as follows:

• Stage 4 – Roadworks which will include:
  - Widening of Princes Highway east-bound carriageway into median in the vicinity of Auburn Street.
  - Adjusting traffic islands and median on Acacia Road leg (southern approach) at intersection.
  - Re-aligning Kingsway-bound left-turn slip lane and widen into southern verge at intersection between Princes Highway and Kingsway.
  - Constructing retaining wall and barrier along northern verge of Princes Highway between Auburn Street and Oak Road, adjacent to local access road which will include excavation for the construction of a footing, installation of formwork and steel reinforcement, concrete pouring, removal of formwork, installation of precast concrete retaining wall panels, and installation of reinforced concrete barrier.

• Stage 5 – Roadworks along northern verge which will include:
- Widening Princes Highway east-bound carriageway into northern verge from Auburn Street to Acacia Road, from Acacia Road to Oak Road, and from Oak Road to Kingsway.
- Widening Oak Road (north) into verge to either side at the intersection between Oak Road (north) and Princes Highway.
- Constructing new local access road between Acacia Road and Oak Road including the introduction of shared zone measures.

- **Stage 6 – Roadworks in median which will include:**
  - Re-aligning existing median along Princes Highway from Auburn Street to Acacia Road, Acacia Road to Oak Road, and Oak Road to Kingsway.
  - Milling and correcting existing pavement to match new pavement.

- **Stage 7 – Ancillary works**
  - Placing of permanent paint markings.
  - Installing road signage.
  - Installing new traffic signals.
  - Installing crash barriers.
  - Grassing and reinstating verges.

All roadworks stages would include the following tasks:

- Setting up of traffic management including safety barriers, delineation of the work site, installation of temporary signage and marking of pavements, deviations and protection to footpaths.
- Demolition of redundant infrastructure which may include kerbs and concrete paths.
- Removal of existing signage.
- Clearing works including the felling of trees and removal of vegetation.
- Relocation of existing electrical and communication utilities which may include decommissioning existing utilities including the removal of poles and filling in of pits, trenching and laying of new underground cabling, or relocation of poles and installation of new overground cabling.
- Sub-surface drainage installation works which will include trenching and excavation for and installation of new pipes and pits at the edge of the new kerb line as well as the removal of redundant drainage pits.
- Earthworks which will include excavation within the existing verge and adjacent roadway, where widening into the verge.
- Breaking out of the existing median and excavation within the median and adjacent roadway, where widening into the median.
- Sub-grade construction works within these excavations which will include compacting and preparation of the existing sub-grade for the construction of pavement layers.
- Pavement construction works, include laying of pavement layers and compaction of these layers.
• Laying of new kerbs and channels, as well as any associated concrete work including the construction of footpaths.

• Pavement finishing including surfacing and re-surfacing works.

• Site clean-up and disestablishment.

Lane closures on Princes Highway, Acacia Road, Oak Road and Kingsway would be required to undertake the majority of works under a Road Occupancy Licence (ROL).

Construction staging and methods would be planned to be delivered by the construction contractor. Construction staging and activities provided in the REF are typical for similar sized road upgrades and widening. The final construction staging and methodology would be determined prior to construction based on the contractors own risk assessments, costs, time and programme. The approval of the ROL by Roads and Maritime would outline the approved methodology for the construction.
LEGEND

- Construction impact area
- Road design

Construction impact area - Acacia Road to Oak Road

Fig. 3.11

Vector backdrop data © MDS 2017, public_NSW_Imagery: © Land and Property Information 2015

Last updated by: DW13219 on 12/05/2017 at 14:59
Construction impact area - Kingsway intersection

Fig. 3.14

Vector backdrop data © MDS 2017, public_NSW_Imagery: © Land and Property Information 2015

Last updated by: DW13219 on 12/05/2017 at 13:49
3.3.2 Construction hours and duration

It is anticipated that the construction of the proposal would take 21 months commencing November 2017, weather permitting.

Construction of the proposal would be undertaken primarily during standard working hours in accordance with the *Interim Construction Noise Guideline* as follows:

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

Due to the high traffic volumes in the area, and to ensure the safety of the workers, some construction activities would be carried outside of standard working hours. Weekend work would also likely be required, subject to permitted road occupancy licences (ROL’s) and construction staging. This is necessary to minimise traffic disruptions on a major road corridor. There would generally be no work on Sunday and public holidays.

Work outside of standard hours (10pm to 5am) would be in accordance with *Roads and Maritime Construction Noise and Vibration Guidelines 2016* and the safeguards contained in this REF.

3.3.3 Plant and equipment

Construction of the proposal would be undertaken using standard road project construction techniques. Typical plant and equipment that may be used during construction includes the following:

- Hand tools
- Generator
- Rollers
- Excavators
- Grader
- Light vehicles and delivery trucks
- Elevated work platform
- Concrete trucks
- Road line marking trucks
- Asphalt pavers
- Transit mixers
- Crane
- Front-end loaders
- Skid steer loaders
- Pavement recycler
- Water trucks.
3.3.4 Earthworks

The proposal would require earthworks for the following:

- Trenching excavation for the relocation of existing utilities and installation of new services along the northern side of the Princes Highway.
- Removal of existing, and construction of new road pavement, medians, drainage, kerbs, road verges and footpaths on the northern side of the Princes Highway.
- Other civil works including road resurfacing.
- Widening of the Princes Highway on the northern side between Oak Road and Acacia Road.
- Construction of a retaining wall along the northern side of the Princes Highway between Oak Road and Acacia Road.
- Fill would be required behind the retaining wall between Oak Road and Acacia Road and at various locations for the length of the proposal.

Excavated materials would likely include milled asphalt, select material and topsoil.

3.3.5 Source and quantity of materials

Fill would be required at various locations across the proposal. The current estimate is 1,530 cubic metres of cut would be generated from the proposal, and 3,200 cubic metres of fill would be required, resulting in a deficit of 1,670 cubic metres of fill that would be required. Final cut and fill volumes would be confirmed during detailed design.

The source and quantity of materials would be determined during the detailed design phase of the Proposal, and would consider the requirements of the *NSW Sustainable Design Guidelines – Version 3.0*. Materials would be sourced from local suppliers where practicable.

Surplus material that is not able to be used on-site as part of the proposal would be reused or disposed of in the following order of priority:

- Transfer to a Roads and Maritime approved site for reuse (with appropriate approvals as required).
- Disposal at an approved materials recycling or waste disposal facility.
- As otherwise provided for by the relevant waste legislation.

The process for management of excess material would be detailed in a Resource and Waste Management Plan (RWMP) that would form part of the CEMP.

Water for construction would be sourced from available hydrants in the area. The required quantities of water are not yet known, however the use of material such as ready mix concrete (required for pavement and kerbs) would reduce the amount of onsite water required during construction. Water would also be required for compaction of pavement layers, such as select layers to adjust the moisture content, and for dust suppression.
3.3.6 Traffic management and access

Traffic management

A Traffic Management Plan (TMP) would be prepared in accordance with Roads and Maritime Services Traffic Control at Work Sites Manual (RTA, 2010), Roads and Maritime Specification G10 – Traffic Management (RMS, 2015). The TMP would provide details of the traffic management to be implemented during construction to ensure that traffic flow is maintained where possible. The TMP would also detail specific routes that construction traffic would follow throughout the construction phase. The TMP would be reviewed by Roads and Maritime prior to commencement of construction.

The works consist of typical construction activities undertaken on urban highway widening projects throughout Sydney in recent decades. Timing of construction activities and traffic management during construction would be detailed in the TMP. The following temporary traffic capacity reductions would be considered in preparing the TMP. These measures aim to minimise traffic impacts during day time and night time construction works:

- **Day time works:**
  - Two live lanes in each direction along Princes Highway (reduced from generally three live lanes)
  - Single live lanes on Oak Road north (reduced from two live lanes).

- **Night time works:**
  - One live lane in each direction along Princes Highway (reduced from generally three live lanes)
  - Oak Road north restricted access (reduced from two live lanes).

It is anticipated that lane closures on the Princes Highway, Acacia Road, Oak Road and Kingsway would be required to undertake the majority of works under a Road Occupancy Licence (ROL). It is expected that some works would be undertaken out of standard hours to minimise impacts on motorists.

All routes would remain open during construction, with potential kerbside or median lane closures using concrete barriers, and reduced speed limits. Any changes to existing traffic movements would be made available to the public through a communications strategy.

Traffic management measures considered above would be confirmed in the TMP prior to construction. Temporary traffic capacity reductions are essential to maintain scheme ‘constructability’, minimise risks to construction workers and the general public during construction. Access will remain restricted to one lane at times, traffic controllers would be employed and reduced speed limits would be put in place.

Vehicle movements

Maintaining traffic flow during construction is a key consideration for construction traffic planning for the proposal. It is expected that a maximum of 26 construction plant and/or heavy vehicles per day during the peak construction period would be required. The majority of these vehicles would undertake trips either predominantly or entirely along the Princes Highway corridor, as well as between the ancillary facilities on Kingsway and the Princes Highway (refer to Figure 3-16).
Traffic flow can be impacted by the presence of heavy vehicles on roads within the proposal and temporary lane closures. The proposed compound sites are located less than two kilometres from the proposal in Miranda (refer to Section 3.3). Kingsway provides a direct route between the compound sites and the proposal.

Table 3-2 lists the expected heavy vehicle numbers during construction. Further minor vehicle movements would be required on site for other components of construction.

Table 3-2 Estimated heavy vehicles required for the proposal

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<th>Heavy vehicle (number required)</th>
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<tr>
<td>Excavators (2)</td>
<td>Skid steer loaders (2)</td>
</tr>
<tr>
<td>Six wheel / semi trucks (6)</td>
<td>Water trucks (2)</td>
</tr>
<tr>
<td>Grader (1)</td>
<td>Flat-bed trucks (2)</td>
</tr>
<tr>
<td>Paver (1)</td>
<td>Pavement recycler (1)</td>
</tr>
<tr>
<td>Transit mixers (3)</td>
<td>EWPs (2)</td>
</tr>
<tr>
<td>Front-end loaders (3)</td>
<td>Crane (1)</td>
</tr>
<tr>
<td>Pile rigger (1)</td>
<td></td>
</tr>
</tbody>
</table>

Due to the proximity of the compound sites to the proposal and the low number of heavy vehicles that are proposed to be used during construction (refer to Table 3-2), the proposal is not anticipated to result in increased traffic congestion during construction.

The TMP would detail specific routes that construction traffic would follow throughout the construction phase. The TMP would be reviewed by Roads and Maritime prior to commencement of construction.

Access

The service road and the Princes Highway would form part of the proposal construction area. Properties which have direct access to the service road or the Princes Highway may require temporary access adjustments, such as detours, during the construction phase. Access to all properties would be maintained during construction, including residential and commercial properties.

Pedestrian access

All existing pedestrian crossings and footpaths would be maintained for the duration of the construction period. There is potential for some footpath impacts to occur during construction. If footpaths are impacted, alternative paths would be established to ensure safe passage of pedestrians through the proposal area.
3.4 Ancillary facilities

3.4.1 Compound sites

There are two compound sites proposed of which one would be selected for use for the proposal. The compound site would provide:

- The site office
- Staff parking
- Stockpile area
- Concrete washout
- Laydown hardstand for materials
- Refuelling area plant and equipment.

The establishment of the compound site would form part of the site establishment works, and would include:

- Erection of site fencing and establishment of erosion and sediment control measures
- Construction of hardstand areas, including dedicated hard stand for plant and equipment, plant inspection and maintenance, vehicle wash down, and bunded storage areas for fuels and chemicals
- Establishment of pre-fabricated or purpose-built temporary offices, crib sheds and storage sheds
- Establishment of temporary utility connections, if not pre-existing and/or sewerage storage and pump out facility if no sewerage connection can be made.

Two potential compound sites have been identified as suitable for use during construction of the proposal. Both these sites are owned by Roads and Maritime. The sites are located in Miranda as shown in Figure 3-17.

- Intersection of Wandella Road/The Boulevarde – This site is located about two kilometres to the east of the eastern end of the proposal. It has been previously used as a compound site by Roads and Maritime. Access from Wandella Road is limited due to the proximity to the traffic lights, however an alternative access point is available from The Boulevarde. A childcare centre is located directly to the west of this site

- Intersection of Sylvania Road and Kingsway - This site is located about 1.3 kilometres from the eastern end of the proposal. There is no access to this site from Kingsway, and access from Sylvania Road may be too close to the intersection. Council owns the lots to the north of this site and may be agreeable to allowing vehicle access from one of their lots down to this site.

Both these sites are predominantly cleared of vegetation and no tree removal would be required for use as a compound site. No further vegetation removal would be undertaken on the sites and a works exclusion zone would be placed around existing strands of trees on each site prior to and for the duration of construction.
LEGEND
Call out boxes:
- Compound site
- Exclusion zone

Fig. 3.17
Vector backdrop data © MDS 2017, public_NSW_Imagery: © Land and Property Information 2015
Last updated by: DW13219 on 15/05/2017 at 10:43
3.4.2 Stockpile sites

Stockpiles would be required for the duration of construction. Construction stockpile sites would temporarily store materials for construction, or materials generated from within the construction site. This could include road base constituents, stripped topsoil, and excess spoil unsuitable for project use.

Stockpiles would be managed in accordance with the requirements of Roads and Maritime’s Stockpile Site Management Procedure (2011) and the QA Specification R44 – Earthworks. Site establishment activities for all stockpile sites would include activities such as the erection of site fencing and establishment of sediment and erosion control measures.

Stockpiles would be located within the boundaries of the compound sites, at an area that would be determined prior to construction to avoid impacts to any trees on site and to exclusion zones (refer to Figure 3-17).

3.5 Public utility adjustment

There are several existing utilities within the proposal including water mains, sewer, communications, electrical poles and street lighting poles. Roads and Maritime has identified the following utilities that would be impacted by the proposal:

- Sydney Water mains:
  - The proposal interfaces with four water main lines (750 millimetre, 500 millimetre, 375 millimetre, 200 millimetre diameters) which run along the northern side of the Princes Highway for the length of the proposed road widening from Auburn Street to Kingsway
  - The existing 375 millimetre and 500 millimetre water mains would be replaced with a 750 millimetre main between Acacia Road and Kingsway. Between Acacia Road and Oak Road the water main would be located away from the proposed retaining wall to allow for future maintenance
  - The existing 200 millimetre reticulation main between Acacia Road and Oak Road may be relocated near the western side of Kingsway and the western side of Bath Road to avoid conflict with the drainage network. This requirement would be determined during detailed design
  - A new valve (600 millimetre) and hydrant would be installed on an existing Sydney Water main (750 millimetre) at a grassed at the corner of Old Princes Highway and Merton Street (refer to Figure 3-15). The valve and hydrant would be enclosed in three one metre wide and one metre long precast pits
  - Sydney Water would be consulted with during detailed design to seek relocation requirements
- Ausgrid low voltage timber overhead poles and mounted street lights on the north bound side of the Princes Highway would be impacted for the length of the proposal from Auburn Street to Kingsway. A 33 kV high voltage transmission pole located on the north bound side of Oak Road may be impacted by the proposal and would require relocation
- A Telstra conduit bank including fibre optic cables would be impacted on the north bound side of the Princes Highway for the length of the proposal from Auburn Street
to Kingsway. The same conduit bank would be relocated near the western side of the Kingsway intersection and the western side of the Bath Road intersection to maintain clearance from the proposed footpath. Optus, Nextgen and SOUL fibre optic cables also run through the impacted duct bank and would be relocated at the same time

- Two low pressure Jemena gas mains crossing Princes Highway near Acacia Road intersection and Bath Road intersection would be impacted and may need to be protected or lowered
- ITS Traffic Systems assets, including conduits, pits, traffic signal poles, would be impacted by the proposal at the Acacia Road, Oak Road and Kingsway intersections
- A VMS gantry on Princes Highway near McDonalds would need to be relocated to the proposed new road edge.

The proposed potable water main adjustments will include:

- Installation of a new isolation valve at the grassed area off the 685 Old Princes Highway, Kirrawee
- About one kilometre of removal and replacement of 375 millimetre and 500 millimetre nominal diameter water mains with a single 750 millimetre nominal diameter between Acacia Road and Bath Road
- About 500 metres of adjustment of a 750 millimetre nominal diameter main in the service road between Acacia Road and Oak Road
- About 90 metres of adjustment of a 200 millimetre nominal diameter main at Kingsway.

The proposed water main adjustments would be constructed using an open trenching technique, with a trench depth of three metres or less.

Construction activities associated with trenching include:

- Site preparation
- Establishing temporary construction compounds at appropriate locations along the pipeline route
- Establishing erosion and sediment control measures
- Vegetation removal
- Trench excavation, stockpiling of spoil material on the upslope side of trenches
- Shoring and dewatering of trenches, depending upon trench depth and groundwater levels
- Spreading of granular material such as sand or gravel along the bottom of the trench prior to laying
- Installing pipeline
- Backfilling the trench with bedding material and excavated soil
- Compacting trench fill material
- Testing and commissioning pipeline

Implementing traffic management measures
• Providing temporary access to properties where trench routes impact driveways
• Site reinstatement.

The proposed construction of the valve and the 200 millimetre diameter water main needs to take place outside of the summer period of 2017. The remaining work needs to be completed in the winter of 2018 to maintain an adequate level of services to residents and businesses in the Sutherland area.

3.6 Property acquisition

No private property acquisition would be required for the proposal.

The parcel of vacant land owned by Roads and Maritime is located at the Kingsway intersection and is shown in Figure 3-18. This property would be acquired to cater for the new slip lane from the Princes Highway into Kingsway proposed to be located there.
LEGEND
- Construction impact area
- Proposal
- Property acquisition of RMS land

Parcel of land owned by RMS at Kingsway intersection

Fig. 3.18
4  Statutory and planning framework

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

4.1  Environmental Planning and Assessment Act 1979

4.1.1  State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

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

Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for a road and is to be carried out by Roads and Maritime, it can be assessed under Part 5 of the Environmental Planning and Assessment Act 1979. Development consent from council is not required.

The proposal is not located on land reserved under the National Parks and Wildlife Act 1974 and does not affect land or development regulated by State Environmental Planning Policy No. 14 - Coastal Wetlands, State Environmental Planning Policy No. 26 - Littoral Rainforests, State Environmental Planning Policy (State and Regional Development) 2011 or State Environmental Planning Policy (Major Development) 2005.

Part 2 of the 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.

4.1.2  Local Environmental Plans

Sutherland Shire Local Environmental Plan 2015

The Sutherland Shire Local Environmental Plan (Sutherland Shire LEP) is the statutory planning document which applies to all land within the Sutherland Shire. Following is a summary of the relevant aspects of the Sutherland Shire LEP which are applicable to the proposal.

Zoning (Clause 2.3)

The proposal is located within land classified as SP2 Infrastructure. The objectives of the SP2 Infrastructure zone is to provide for infrastructure and related uses; and to prevent development that is not compatible with or that may detract from provision of infrastructure.

The proposal is consistent with the objectives of this zone and the LEP states that it is permissible with consent. However, the proposal is permissible under Clause 94 of the ISEPP and can be carried out by or on behalf of a public authority without consent.
The sites proposed for use as compound sites are zoned SP2 Infrastructure. A small portion of the site at the intersection of Kingsway and Sylvania Road, through which vehicular access may be required, is zoned RE1 Public Recreation. Roads are permitted within this zone consent. Again, ISEPP applies to the proposal and consent from Council would not be required.

Land use zonings within the proposal and nearby are shown on Figure 4-1.

**Preservation of trees / vegetation (Clause 5.9)**

Clause 5.9 of the LEP specifies that the amenity of the area should be preserved, including biodiversity values, through the preservation of trees and other vegetation. It applies to species or kinds of trees or other vegetation that are prescribed for the purposes of this clause by a Development Control Plan (DCP) made by the Council, and that a permit or development consent from Council is required should this vegetation be physically impacted.

The Draft Sutherland Shire DCP 2015 (map 26) maps vegetation along the Princes Highway between Kenneth Avenue and Auburn Road as ‘threatened species’ and ‘threatened species – buffer’. Flora investigations undertaken by SMEC identified that these trees may have formed part of a threatened ecological community in the past however the vegetation within the proposal does not constitute a threatened ecological community. This is discussed further in Chapter 6.

**Heritage conservation (Clause 5.10)**

Clause 5.10 of the LEP aims to conserve the environmental heritage of Sutherland Shire; to conserve the heritage significance of heritage items and conservation areas; to conserve archaeological sites; and to conserve Aboriginal objects and Aboriginal places of heritage significance. The LEP heritage maps show two stands of trees (Items 3601 and 1509) of local heritage significance in the proposal:

- Item 3601 – Tree cluster along the northern side of the Princes Highway between Acacia Road and Auburn Road
- Item 1509 – Stand of trees on both sides of the Princes Highway to the east of the intersection with Kingsway.

The potential impacts of the proposal on biodiversity and heritage are discussed in Chapter 6.

**Environmentally sensitive land – terrestrial biodiversity (Clause 6.5)**

Clause 6.5 of the LEP aims to maintain terrestrial biodiversity by protecting native flora and fauna; to protect the ecological processes necessary for their continued existence; and to encourage the conservation and recovery of native fauna and flora and their habitats. This clause applies to land identified as ‘environmentally sensitive land’ on the terrestrial biodiversity map of the LEP and states that the consent authority must consider whether the development is likely to have an adverse impact on the flora and fauna on the site.

One of the potential compound sites located at the corner of Kingsway and Sylvania Road is mapped as environmentally sensitive land and contains a cluster of trees in the southern part of the site. The proposed use of this land for a compound site would not impact on the trees and this is considered further in Chapter 6.
### Land use

**Fig. 4.1**

- **Proposal**
- **Land Zoning (LZN)**: B1 Neighbourhood Centre, B2 Local Centre, B3 Commercial Core, B4 Mixed Use, B6 Enterprise Corridor, E2 Environmental Conservation, E4 Environmental Living, IN1 General Industrial, IN2 Mixed Use, IN3 Commercial Core, IN4 Medium Density Residential, IN5 High Density Residential, IN6 Medium Density Residential, IN7 High Density Residential, IN8 Medium Density Residential, IN9 High Density Residential, RE1 Public Recreation, RE2 Private Recreation, SP1 Special Activities, SP2 Infrastructure, DM Deferred Matter

**Proposed Areas**:
- Sutherland
- Stapleton Avenue
- Acacia Road North
- Glenrose Street
- Princes Highway
- Waratah Street
- Bath Road
- Toronto Parade
- Kingsway
- The Boulevarde
- The Grand Parade
- The Grand Parade

**Water main adjustments**

**Legend**:
- Proposal
- Land Zoning (LZN): B1 Neighbourhood Centre, B2 Local Centre, B3 Commercial Core, B4 Mixed Use, B6 Enterprise Corridor, E2 Environmental Conservation, E4 Environmental Living, IN1 General Industrial
- R2 Low Density Residential
- R3 Medium Density Residential
- R4 High Density Residential
- RE1 Public Recreation
- RE2 Private Recreation
- SP1 Special Activities
- SP2 Infrastructure
- DM Deferred Matter

**Fig. 4.1**

- **Land use**
- **0 100 200 Metres**

**Land Zoning by NSW DP&E 2017**

Last updated by: DW13219 on 24/04/2017 at 21:02
Draft Development Control Plan 2015

The Draft Development Control Plan (DCP) provides detailed planning and design guidelines to support the planning controls in the Sutherland Shire LEP and has been taken into consideration during preparation of the REF. The Draft DCP contains vegetation mapping and outlines Council’s biodiversity strategy, which aims to conserve and enhance Sutherland Shire’s bushland and biodiversity by identifying and appropriately managing key areas of bushland habitat and establishing and maintaining interconnecting linkages and corridors.

4.2 Other relevant NSW legislation

4.2.1 Environmental Planning and Assessment Act 1979

The 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 Part 5 of the EP&A Act. Part 5 of the EP&A Act specifies the environmental impact assessment requirements for activities undertaken by public authorities, such as TfNSW, which do not require development consent under Part 4 of the EP&A Act.

In accordance with Section 111 of the EP&A Act, TfNSW, 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 Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) defines the factors which must be considered when determining if an activity assessed under Part 5 of the EP&A Act would have a significant impact on the environment.

Chapter 5.1.2 of the REF provides an environmental impact assessment of the Proposal in accordance with clause 229 and Appendix B specifically responds to the factors for consideration under clause 228.

4.2.2 Threatened Species Conservation Act 1995

The TSC Act aims to conserve biological diversity by protecting and encouraging the conservation of threatened species, populations and ecological communities and their critical habitats.

This REF takes into consideration the potential impacts of the proposal on threatened species, populations, ecological communities and critical habitat listed on the TSC Act (refer to Chapter 6).

Vegetation present from Auburn Street to the east of Acacia Road has been mapped by the Office of Environment and Heritage (OEH) as Sydney Turpentine Ironbark Forest, an endangered ecological community listed under the TSC Act. An ecologist undertook field surveys on 22 November 2016. Field surveys concluded the vegetation currently present at this location does not conform to the definition of Sydney Turpentine Ironbark Forest as defined within the Scientific Determination. This is discussed further in Chapter 6.
4.2.3 Heritage Act 1977

The Heritage Act 1977 (Heritage Act) provides for the protection and conservation of NSW’s environmental heritage.

Under the Act, an item is defined as a place, building, work, relic, moveable object or precinct and a relic is defined as any deposit, artefact, object or material evidence that:

- Relates to the settlement of the area that comprises NSW, not being Aboriginal settlement, and
- Is of State or local heritage significance.

Section 139 requires an excavation permit to disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed. A permit is also required to disturb or excavate any land on which the person has discovered or exposed a relic. The proposal is unlikely to impact on non-Aboriginal heritage. Further details on non-Aboriginal heritage are provided in Section 6.

4.2.4 Protection of the Environment Operations Act 1997

The Protection of the Environment Operations Act 1997 (PoEO Act) regulates certain activities with respect to pollution impacts (such as air, water and noise pollution). Part 3.2 of the PoEO Act requires an Environmental Protection Licence (EPL) for scheduled development work and carrying out scheduled activities.

Item 35 of Schedule 1 of the Act applies to road construction, meaning the construction, widening or rerouting of roads. Any activity to which the definition applies is declared to be a scheduled activity if it results in the existence of four or more traffic lanes (other than bicycle lanes or lanes use for entry or exit) for at least:

(a) Where the road is classified, or proposed to be classified as a freeway or tollway under the Roads Act 1993:
   i. 1 kilometre of their length in the metropolitan area, or
   ii. 5 kilometres of their length in any other area.

(b) Where the road is classified, or proposed to be classified, as a main road (but not a freeway or tollway under the Roads Act 1993:
   i. 3 kilometres of their length in the metropolitan area, or
   ii. 5 kilometres of their length in any other service.

The proposal involves the upgrade of a 1.25 kilometre section of a highway in the Sydney metropolitan area and is therefore not a ‘scheduled activity’ under Schedule 1 of the POEO Act and would not require an EPL.

The PoEO Act also identifies a number of pollution offences, including offences relating to:

- The wilful or negligent disposal of waste in a manner that harms or is likely to harm the environment
- The wilful or negligent causing of a substance to leak, spill or otherwise escape (whether or not from a container) in a manner that harms or is likely to harm the environment
• The wilful or negligent causing of any controlled substance to be emitted into the atmosphere in contravention of the regulations under the Ozone Protection Act 1989 and in a manner that harms or is likely to harm the environment

• Water pollution
• Air pollution
• Noise pollution
• Land pollution and waste.

The construction contractor and Roads and Maritime are obliged to notify the EPA if a pollution incident occurs that causes or threatens material harm to the environment. Appropriate mitigation and management measures would be established and maintained to avoid pollution incidents and these are outlined in Section 6 of this REF.

4.2.5 Noxious Weeds Act 1993

The Noxious Weeds Act 1993 provides for a coordinated approach to the removal and control of scheduled noxious weeds across NSW. No permits or approvals are required under this Act, but it is the responsibility of Roads and Maritime to provide for the removal and proper disposal of any listed weeds found within the proposal site. Noxious weeds are discussed and management measures proposed in Section 6.

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 A and chapter 6 of the REF.

A referral is not required for proposed road activities that may affect nationally listed threatened species, populations, 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.

The assessment of the proposal’s impact on matters of national environmental significance and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance or on Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Department of the Environment under the EPBC Act.

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

The proposal is categorised as development for the purpose of a road and is being carried out by or on behalf of a public authority. Under clause 94 of the ISEPP the proposal is permissible without consent. The proposal is not State significant infrastructure or State significant development. The proposal can be assessed under Part 5 of the EP&A Act.

Roads and Maritime is the determining authority for the proposal. This REF fulfils Roads and Maritime’s obligation under clause 111 of the EP&A Act to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.
5 Consultation

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

5.1 Consultation strategy

Roads and Maritime proposed the following activities as part of their consultation strategy:

- Community update
- Public display of the REF and an invite for submissions on the proposal
- Consultation with Sutherland Shire Council in accordance with the ISEPP.

5.2 Community involvement

The community will be consulted through public exhibition of the REF, community information sessions held during the REF display period, and an invite to comment on the REF through submissions.

The REF will be placed on public display for four weeks from Monday 29 May to Monday 26 June 2017 and written submissions will be invited during this period. Further community consultation will be undertaken during the public display period to enable the community to comment and ask questions about the Proposal.

Planned consultation activities associated with the public display include:

- public display of the REF documents at the following locations:
  - Sutherland Shire Council - 4/20 Eton St, Sutherland
  - Miranda Library - 31 Wandella Rd, Miranda
  - Sylvania library - Southgate Shopping Centre, Port Hacking Rd, Sylvania
  - Sutherland Library - 30-36 Belmont Street, Sutherland
- all documents available on the Easing Sydney’s Congestion website.

5.3 Aboriginal community involvement

The proposal has been considered against the requirements of the Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) (Roads and Maritime Services, 2011). This procedure is generally consistent with the Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (Department of Environment, Climate Change and Water, 2010). An outline of the procedure is presented in Table 5-1.

Table 5-1 Summary of Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation
<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>Initial Roads and Maritime assessment</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Site survey and further assessment</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Formal consultation and preparation of a cultural heritage assessment report</td>
</tr>
<tr>
<td>Stage 4</td>
<td>Implement environmental impact assessment recommendations</td>
</tr>
</tbody>
</table>

A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System), undertaken on 23 November 2016, has shown that no Aboriginal sites are recorded in or near the proposal location including the site compounds, and no Aboriginal places have been declared in or near the above location.

Following Stage 1 of the PACHCI process (clearance letter dated 2 March 2017), Roads and Maritime noted no presence of previously recorded Aboriginal sites near the proposal site and decided that no further assessment was needed (refer to Appendix G).

### 5.4 ISEPP consultation

Part 2, Division 1, Clauses 13-15 of the ISEPP specify consultation requirements for infrastructure development to be carried out under the ISEPP. These largely relate to the requirement for public authorities other than local councils to consult with the relevant local council as part of the assessment process. Consultation is required if the proposal would affect council infrastructure or services, impact on a local heritage item or if development would impact on flood liable lands.

Sutherland Council have been consulted about the proposal as per the requirements of clause 13(1) of the ISEPP. Consultation under ISEPP is required as the proposal would include impacts to LEP listed trees, the introduction of a ban on right turns from Oak Road and adjustments to the service road. The proposal would result in the footpath being retained and the grass verge to be narrowed slightly. Sutherland Shire Council have been consulted on the proposal since the strategic design and are in support of the proposal. Appendix A contains an ISEPP consultation checklist that documents how ISEPP consultation requirements have been considered.

Responses to ISEPP consultation would be provided in the Submissions Report to be prepared for the proposal following public exhibition.

Table 5-2 Issues raised through stakeholder consultation to date
<table>
<thead>
<tr>
<th>Agency</th>
<th>Issue raised</th>
<th>Response / where addressed in REF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sutherland Shire Council</td>
<td>The Strategic Design proposed blocking off the access to the service Road opposite Kingsway to prevent the ‘rat run’ noticed during peak hours to avoid the Waratah Street intersection.</td>
<td>The proposed closure was discussed at the stakeholder meeting with Council and RMS. It was decided that given the number of businesses that currently utilise the service road, closing it would lead to opposition from the current businesses. In addition, prevention of the ‘rat run’ during peak hours was not deemed sufficient to close the service road and impact current access arrangements of a number of businesses and car dealerships in the area. The proposed closure was removed from the proposal and access will remain as existing.</td>
</tr>
<tr>
<td></td>
<td>Site visit on 30/3/17 with the Sutherland Shire Natural Areas Manager, requested a landscaping plan for the alignment to be developed in consultation with council. Including detail on the planting species mix and translocation of tree saplings. Request for use of specific seed mixes and sourcing from local nurseries was also discussed.</td>
<td>Refer to section 6.1.4 and 6.6.4 A landscaping plan will be developed in consultation with Sutherland Shire Council prior to construction.</td>
</tr>
</tbody>
</table>

### 5.5 Government agency and stakeholder involvement

Key stakeholders associated with this proposal are:

- Sutherland Shire Council
- Utility authorities (Ausgrid, NBN, Optus, Transgrid, Sydney Water, Jemena, Telstra)
- Deicorp developer
- Residents along the proposal
- Customers using the road
- Businesses along the proposal, including Domenelli Ford, McDonald’s Kirrawee and BP Service Station.

A Stakeholder Consultation Workshop was held with Sutherland Shire Council on 25 October 2016. Roads and Maritime stakeholders and a Sutherland Shire Council representative attended the workshop. The concept design of the proposal was
presented at the workshop. Issues that have been raised as a result of consultation with Sutherland Shire Council are outlined above in Table 5-2.

5.6  Ongoing or future consultation

5.6.1 Submissions Report

This REF will be placed on public exhibition and community comments will be invited (refer to Section 5.2). At the conclusion of the public display period for the REF, Roads and Maritime will acknowledge receipt of feedback from each respondent. The issues raised by respondents will be consolidated and considered by Roads and Maritime Services.

A submissions report will be prepared summarising the key impacts identified in this REF, demonstrating how Roads and Maritime considered issues raised during the public display period, and include a summary of mitigation measures proposed to minimise the impacts of the proposal. The submissions report will be made available on the Easing Sydney’s Congestion website and everyone who made a submission will be individually notified of the outcome.

5.6.2 Construction phase

Should Roads and Maritime proceed with the proposal, consultation activities would continue up to and during construction. These consultation activities would include:

- Consultation with directly impacted community stakeholders to assist in managing impacts during construction
- Ongoing updates to the immediately affected community during the detailed design phase and the construction period.
- Ongoing consultation with Sutherland Shire Council and other relevant government agencies

A website for ESC would be accessible that would provide an overview of the project.
6 Environmental assessment

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

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

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

6.1 Biodiversity

6.1.1 Methodology

A flora investigation was undertaken by an ecologist from SMEC to identify the vegetation present within the proposal, focusing on the section of the proposal between Auburn Street and Oak Road. The investigation involved:

- Review of The Native Vegetation of the Sydney Metropolitan Area v. 2 (OEH, 2013) and NSW Plant Community Types
- Review of the Sutherland Shire LEP, specifically Clause 5.9 Preservation of trees / vegetation and Clause 5.10 Heritage conservation
- A site investigation (November 2016) involving:
  - A random meander transect within roadside vegetation between Auburn Street and Oak Road on the south bound side of the Princes Highway
  - Identification of plants in accordance with Flora of New South Wales Volumes 1-4 (Harden, 1990 to 2003)
  - Assessment of site conditions, including soil type, topography, vegetation communities and habitat value.

The field investigations did not include targeted searches for threatened flora or fauna species or a fauna habitat assessment.

The conservation significance of the biodiversity recorded during the site investigations was determined in accordance with the TSC Act and EPBC Act.
6.1.2 Existing environment

The Princes Highway at Kirrawee is located in an area that has been previously cleared for urban development, with land on either side of the highway comprising roads, residential properties, retail and commercial properties. The local area supports native vegetation both within road reserves, Council managed reserves and parks and private property.

Narrow stands of trees occur within the Princes Highway road reserve between Auburn Street and Oak Road (refer to Figure 6-1 to Figure 6-3). To the east of Oak Road a mixture of juvenile and mature planted trees occur along the road verge (refer to Figure 6-4).

Two clusters of trees located within the proposal are of local heritage significance. One cluster occurs along the northern side of the Princes Highway between Auburn Street and Acacia Road and the other occurs on both sides of the Princes Highway to the east of the intersection with Kingsway.

The two sites being considered for use as a compound site are largely cleared and have been used for this purpose in the past (refer to Figure 6-5 and Figure 6-6).

![Figure 6-1 Vegetation present on the shared path along the north bound side of the Princes Highway between Acacia Road and Oak Road (looking west).](image1)

![Figure 6-2 Vegetation present on the shared path along the north bound side of the Princes Highway between Acacia Road and Oak Road (looking east).](image2)
Vegetation communities

A search of the Atlas of NSW Wildlife indicates that 29 threatened flora species and 76 threatened fauna species and four endangered populations have been previously recorded within 10 kilometres of the proposal, this included the compound sites. The EPBC Protected Matters Database search listed one wetland of international importance, three threatened ecological communities, 61 threatened species and 30 migratory species within two kilometres of the proposal.

Vegetation present between Auburn Street and the east of Acacia Road is mapped as Sydney Turpentine Ironbark Forest (STIF) (OEH) (refer to Figure 6-1 to Figure 6-3). This community is listed as an endangered ecological community under the TSC Act and critically endangered ecological community under the EPBC Act. A stand of vegetation at the intersection of the Princes Highway south bound and Kingsway is mapped as Coastal Shale Sandstone Forest.

Following the site inspection on 22 November 2016, ground truthing of the vegetation between Auburn Street and Oak Road identified the vegetation as a mixture of planted native and exotic tree species, with a disturbed exotic understorey. The canopy is dominated by planted Eucalypt species, including *Eucalyptus crebra*, *Eucalyptus microcorys*, *Lophostemon confertus*, *Angophora costata* and *Corymbia maculata*. The groundcover is dominated by exotic weeds and perennial grass species, including *Ehrharta erecta*, *Eragrostis curvula*, *Bidens pilosa* and *Sonchus oleraceus*. The mid and understorey strata are absent except in areas which have been planted with native species such as *Lomandra longifolia*, *Hibbertia scandens*, *Doryanthes excelsia* and *Dianella caerulea*.

A small number of remnant canopy species, *Eucalyptus pilularis* and *Angophora costata*, are present. While both species are considered component species of STIF, they are
also commonly found in non-threatened vegetation communities. The vegetation from Auburn Street to the east of Oak Road in its current condition does not conform to the definition of STIF provided for this community.

No noxious weeds were recorded along the Princes Highway during the site inspection.

**Fauna habitats**

While targeted threatened flora and fauna searches were not undertaken for the proposal, the site inspection undertaken on 22 November 2016 and use of aerial imagery indicate the Princes Highway corridor is largely devoid of habitat suitable to support threatened flora and fauna species. This is due to the extensive clearing that has taken place in the past.

The vegetation, comprising mainly scattered planted trees (refer to Figures 6-1 to 6-6), provides habitat for a variety of arboreal mammal and bird species commonly found in urban environments, such as Brush-tail Possums, Ring-tail Possums, Kookaburras and Cockatoos.

The vegetation is considered to provide limited foraging and roosting habitat for threatened birds, microchiropteran bats and Grey-headed Flying-foxes on a transitional basis only.

### 6.1.3 Potential impacts

**Construction**

The proposal would require the removal of trees from the north bound edge of the Princes Highway road reserve between Auburn Street and Kingsway where road widening is proposed (refer to Figure 6-7) and the median. Trees would also be removed along the verge of Acacia Road to provide for the western extent of the Acacia Road to Oak Road retaining wall at this location. A further two mature trees would be removed from the south bound edge of the Princes Highway on approach to the Kingsway. The trees to be removed comprise native and introduced species and recent plantings, and do not comprise threatened species or form part of threatened ecological communities. Some of the trees to be removed are of local heritage significance and are listed on the Sutherland Shire LEP.

Information about the trees impacted by the proposal is in Section 6.5. Trees to be removed consist of the following species:

- *Eucalyptus microcorys* (Tallow Wood)
- *Eucalyptus pilularis* (Blackbutt)
- *Eucalyptus saligna* (Sydney Blue Gum)
- *Eucalyptus racemosa* (Snappy Gum or Small-leaf Scribbly Gum),
- *Eucalyptus grandis* (Rose Gum)
- *Eucalyptus globoidea* (White Stringybark)
Clearing of trees from the Princes Highway road reserve would result in the removal of habitat for native fauna species that may currently use the trees for foraging, roosting or for shelter on occasions. About 53 of the trees were recently planted and are of little or no habitat value for fauna species. It is unlikely any native fauna species would be dependent on these trees due to the mostly scattered location of the trees along the verge and position along a busy and noisy highway. Fauna species which may use the trees as a habitat resource would be able to utilise other similar trees in adjacent areas.

Use of the potential compound sites would not impact biodiversity as the sites are already cleared (refer to Figure 3-17). The Sydney Water installation works located at the west end of the project would not require the removal of any trees (refer to Figure 3-15).

**Operation**

There would be no ongoing operational risks to biodiversity as a result of the operation of the proposal.

**Conclusion on significance of impacts**

The proposal is not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the TSC Act or Fisheries Management Act 1994 and therefore a Species Impact Statement is not required.

The proposal is not likely to significantly impact threatened species, populations, ecological communities or migratory species, within the meaning of the EPBC Act.
### 6.1.4 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodiversity management during construction</td>
<td>Develop a Biodiversity Management Plan prior to construction to be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Biodiversity during construction</td>
<td>Contractor</td>
<td>Pre-construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.</td>
<td>Contractor</td>
<td>Detailed design / pre-construction</td>
<td>Core standard safeguard B2</td>
</tr>
<tr>
<td>Noise, light and vibration</td>
<td>Shading and artificial light impacts will be minimised through detailed design.</td>
<td>Roads and Maritime</td>
<td>Detailed design</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Tree protection</td>
<td>Tree protection around retained trees will be implemented in accordance with Australian Standard 4970-2009 Protection of trees on development sites.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Tree removal and re-planting</td>
<td>A landscaping plan will be developed in consultation with Sutherland Shire Council prior to construction and will include detail on the planting species mix and consideration of translocation of tree saplings.</td>
<td>Roads and Maritime / Contractor</td>
<td>Pre-construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td></td>
<td>Native vegetation removal will be minimised through detailed design.</td>
<td>Roads and Maritime</td>
<td>Detailed Design</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td></td>
<td>Pre-clearing surveys will be undertaken in accordance with Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RMS projects (RTA 2011).</td>
<td>Contractor</td>
<td>Pre-construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
<td>----------------------</td>
<td>-----------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Vegetation removal</td>
<td>Vegetation removal will be undertaken in accordance with Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RMS projects (RTA 2011).</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Native vegetation</td>
<td>Native vegetation will be re-established in accordance with Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RMS projects (RTA 2011).</td>
<td>Roads and Maritime / Contractor</td>
<td>Post construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Injury and mortality of fauna</td>
<td>Fauna will be managed in accordance with Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RMS projects (RTA 2011).</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Discover of unexpected threatened flora or fauna</td>
<td>The unexpected species find procedure is to be followed under Biodiversity Guidelines: Protecting and managing biodiversity on RMS projects (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional standard safeguard F3</td>
</tr>
<tr>
<td>Edge effects on adjacent native vegetation and habitat</td>
<td>Exclusion zones will be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RMS projects (RTA 2011).</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>
### Impact | Environmental safeguards | Responsibility | Timing | Standard / additional safeguard
--- | --- | --- | --- | ---
Noxious weed management | Declared noxious weeds are to be managed according to requirements under the *Noxious Weeds Act 1993 and Guide 6 (Weed Management) of the Roads and Maritime Services Biodiversity Guidelines 2011.* | Contractor | Construction | Additional standard safeguard F6

Pruning and trimming of trees | All pruning and trimming of trees is to be in accordance with the *Australian Standard 4373-2007 Pruning of amenity trees.* Pruning of mature trees is to be undertaken by a qualified arborist. | Contractor | Construction | Additional standard safeguard F9

### 6.2 Soils

#### 6.2.1 Methodology

Landform, geology and soil landscape information was sourced from available reference material including:

- Acid Sulfate Soil Risk
- Natural occurring asbestos in NSW
- LEP layers and land use (Sutherland Shire Council)
- Geology and soil formation (NSW 1:250 000 State wide Geology)
- Soil pH (Digital Atlas of Australian Soils)
- Contaminated land (Environmental Protection Authority)
- Salinity (Salinity hazard report for Catchment Action Plan upgrade – Sydney Metropolitan CMA – NSW Department of Primary Industries)

This was supplemented with observations from an environmental site investigation for the Gateway to South Pinch Points Program (AECOM 2016). Environmental investigation locations are shown on Figure 6-8.

#### 6.2.2 Existing environment

**Soil landscapes**

The proposal falls within the Gymea Soil Landscape unit which is characterised by:

- Undulating to rolling rises and low hills on Hawkesbury Sandstone
• Moderately inclined slide slopes with wide benches
• Localised rock outcrops on low broken scarps.

The soils are shallow to moderately deep Yellow Earth and Earth sands, with Gleyed Podzolic Soils and Yellow Podzolic Soils on shale lenses. The Hawkesbury Sandstone formation is comprised of the clastic sediment rock types including claystone, siltstone and laminate from braided alluvial and abandoned channel fill.

The proposal area has been previously disturbed by the construction of the Princes Highway. At the intersection of Oak Road and the Princes Highway, the majority of material was identified to be silty clay fill material and underlying natural clay (AECOM 2016).

Acid Sulfate Soils

Acid sulfate soil occurs predominantly on coastal lowlands, with elevations generally below five metres and is therefore not expected within the proposal area. A search of the Sutherland Shire Council Local Environment Plan (2015) indicated Acid Sulfate Soils were not present within the study area including site compounds.

The Digital Atlas of Australian Soils classified the soil within the study area to be acidic throughout (pH < 6.5) and relatively sodic with strongly sodic acid duplex soils integrating into normal forms.

Salinity

Salinity for the study area was investigated utilising the Salinity hazard report for Catchment Action Plan upgrade – Sydney Metropolitan CMA. The study identified the proposal area to be of very low salinity hazard.

Contaminated land

A search of the NSW Environmental Protection Authority (EPA) database (conducted on 2 March 2017) identified various sites of potential contamination concern in proximity to the proposal and site compound areas. Table 6-1 displays contaminated sites notified to EPA which have been assessed in accordance with the Contaminated Land Management Act 1997 (CLM Act).

Table 6-1 Contaminated sites notified to EPA

<table>
<thead>
<tr>
<th>Contamination causing activity</th>
<th>Site description and address</th>
<th>EPA site management class</th>
<th>Distance from proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Station</td>
<td>7-Eleven Service Station 693 Old Princes Highway</td>
<td>Under assessment</td>
<td>730 metres west</td>
</tr>
<tr>
<td>Service Station</td>
<td>Caltex-branded Kirrawee Service Station (1-3 Waratah Street) 487 Princes Highway</td>
<td>Regulation under CLM Act not required</td>
<td>315 metres north east</td>
</tr>
<tr>
<td>Contamination causing activity</td>
<td>Site description and address</td>
<td>EPA site management class</td>
<td>Distance from proposal</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------</td>
<td>---------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Metal Industry</td>
<td>Ingal Civil Products 127-141 Bath Road</td>
<td>Regulation under CLM Act not required</td>
<td>80 metres north</td>
</tr>
<tr>
<td>Service station</td>
<td>Coles Express Kirrawee 470 Princes Highway</td>
<td>Under assessment</td>
<td>700 metres north east</td>
</tr>
<tr>
<td>Service station</td>
<td>7-Eleven (former Mobil) Service Station 542 Princes Highway</td>
<td>Regulation under CLM Act not required</td>
<td>Located within the proposal area</td>
</tr>
</tbody>
</table>

The 7-Eleven Service Station on the corner of Bath Road and the Princes Highway, is the only listed site within the proposal area. This site has been classified as ‘Regulation under CLM Act not required’. The sites listed in Table 6-1 would not be impacted by excavation activities undertaken for the proposal.

**Environmental Site Investigation**

A site investigation was completed between Princes Highway, Kenneth Road and Oak Road in August 2016. Field observations and analytical laboratory results were assessed together to develop a thorough understanding of the proposal area. Three soil borings were installed at Oak Road, adjacent to the BP Service Station. The site was assessed for environmental aesthetic conditions, targeting signs of potential hydrocarbon odours, staining on surface soil and pavement, and potential stress on plants offsite down gradient from potential contamination in surface soils on the site.

Based on the assessment which including field monitoring using the PID to assess potential for VOCs and a visual survey, there were no visual signs of contamination. There was an absence of surface staining or noticeable stress to vegetation. PID results recorded low readings (below 0.1 ppm) on the site with and no unpleasant “nuisance” odours detected from the surface soils.

A summary of the results from the field investigation is outlined below:

- Concentrations of metals were below the HIL ‘D’ for commercial/industrial land use for all samples analysed.
- Concentrations of TRH, BTEX, PAH and Phenols OC/OP pesticides were below laboratory reporting limits and/or below adopted assessment criteria for all samples analysed.
- Concentrations of metals were below the EILs for commercial and industrial land use for all samples analysed.

It has been determined from the investigation that contaminants of potential concern were below the adopted investigation levels at all sample locations tested and that the potential risk posed to workers conducting shallow intrusive works (less than 1.5m bgl) is low and acceptable (AECOM 2016).
LEGEND

- **Soil test locations (indicative only)**
  - Proposal
  - Construction impact area

- **Test pit location (indicative only)**

Fig. 6.8
6.2.3 Potential impacts

Construction

Potential impacts on the soils, topography and geology of the proposed construction works would primarily be associated with the erosion of exposed soils and stockpiles, and associated potential sedimentation of surrounding land and stormwater infrastructure. With the implementation of appropriate construction and management techniques, such impacts would be effectively mitigated and minimised.

During construction, several work elements have the potential to expose soils which have the potential to lead to erosion and sedimentation, as well as exposure of contaminated soils including:

- Earthworks within the construction impact area.
- Drainage works
- Construction of retaining walls
- Vehicle movements
- Removal and installation of general fill material
- Stockpiling
- Vegetation removal
- Grubbing processes
- Landscaping.

Erosion and sedimentation

Earthworks and excavation is required along the length of the proposal (northern side) between Acacia Road and Oak Road for road widening and the installation of the proposed retaining wall (refer to Section 3).

The proposal has the potential to generate sediment during rainfall events due to ground disturbing activities during construction, including excavation and vegetation removal. A further potential impact is sediment mobilisation from soil deposited on road pavements during works. Sedimentation to roadside stormwater systems has the potential to mobilise to nearby waterways, increasing turbidity and affecting aquatic life by limiting access to light. It can also alter drainage line hydrology due to the deposition of sediment over time.

Rainfall erosivity and soil erodibility are consistent across the site and therefore the highest risk construction activities for erosion and sedimentation would generally be where the ground disturbance is greatest.

Diversion controls would be installed to divert offsite water around the construction work sites. To address potential erosion and sedimentation impacts safeguards and mitigation measures would be implemented during construction (refer to Section 6.2.4).

Earthworks would be undertaken for the widening to the northern side and alignment of Princes Highway. These earthworks would not alter the existing topography from a regional perspective and would only be noticeable in the direct vicinity of the proposal.
The main identified high risk areas of erosion and sedimentation resulting from earthworks are as follows:

- **Construction of retaining wall**
  - The retaining wall on the northern side of Princes Highway between Acacia Road and Oak Road which would be about 410 metres long. The retaining wall would be required in order to minimise the construction footprint while ensuring slope stability. The retaining wall has been designed to allow the necessary carriageway widths for the additional through lanes, while maintaining slope stability and minimising the construction footprint into the shared path and service road.
  - Construction of the retaining wall would require placement of backfill material with outlet points to stormwater systems. This element of construction would require vegetation removal and placement of fill material using earth moving equipment.

- **Road widening**
  - Widening on the northern side of the Princes Highway between Oak Road and Bath Road to provide a new slip lane into McDonalds.
  - Widening on the Princes Highway (south bound) to provide a dedicated turning lane into Kingsway.
  - Construction of the new slip lane would require excavation into the existing wide roadside verge, and placement of new pavement material using earth moving equipment.

- **Trenching for utilities**
  - Construction would include excavation and trenching at various locations along the northern side of the Princes Highway length of the proposal.
  - Excavation for trenching is required to accommodate the relocation of existing utilities and installation of new services and would involve the removal and placement of fill material using earthmoving equipment.

- **Construction of new road pavement**
  - This construction activity would involve the removal of existing, and construction of new road pavement, medians, drainage, kerbs, road verges and footpaths on the northern side of the Princes Highway. Other civil works including road resurfacing.
  - Excavated materials would likely include milled asphalt, select material and topsoil.

- **Activities undertaken at site compound**
  - Stockpile area
  - Concrete washout
  - Laydown hardstand for materials
  - Refuelling area plant and equipment.

Fill would be required at various locations across the proposal. Current estimates that 1,530 cubic metres of cut would be generated from the proposal, and 3,200 cubic metres
or fill would be required, resulting in a deficit of 1,670 cubic metres of fill that would be required. Final cut and fill volumes would be confirmed during detailed design. Materials would be sourced from local commercial suppliers where feasible.

**Contaminated land**

There is limited potential for contaminated land to be encountered during construction activities. However, excavation required as part of the road widening on the northern side of the Princes Highway may encounter unidentified contaminated material. It is also possible that contaminated land may exist in adjoining sites as a result of historical land uses and associated contamination (refer to Table 6-1).

Potential environmental impacts associated encountering contaminated land during construction include:

- Increased waste volumes from excavated (potentially contaminated) materials
- Adverse effects on human health (construction personnel, travelling public or nearby communities)
- Movement of contaminated sediments via surface runoff into stormwater systems

During construction, groundwater quality could also potentially be affected by infiltration of pollutants into the soils. If not appropriately managed, these pollutants could reach perched groundwater. General sources of potential groundwater pollution during construction works include infiltration/run off from excavation / disturbance of the truck incident area, any associated contaminated soil stockpiles and the other areas of environmental concern identified in Table 6-1.

**Operation**

There is expected to be minimal impact on landform and soils following completion of construction and once disturbed areas have been stabilised.

It is not expected that the proposal would have any ongoing contaminated land impacts after the completion of construction because any identified contaminated material would be removed off site to be legally disposal of or managed safely on-site. In addition, disturbed areas would be stabilised and suitable pavement and cross drainage would be in place.
### 6.2.4 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential or actual acid sulphate soils</td>
<td>• Potential or actual acid sulphate soils are to be managed in accordance with the Roads and Maritime Services Guidelines for the Management of Acid Sulphate Materials 2005.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard X1</td>
</tr>
<tr>
<td>Erosion &amp; sedimentation controls</td>
<td>Erosion and sediment control measures are to be implemented and maintained to:</td>
<td>Contractor</td>
<td>Pre-construction/ Construction</td>
<td>Core standard safeguard E1</td>
</tr>
<tr>
<td></td>
<td>• Minimise sediment laden water entering any water course, drainage lines, or drain inlets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Reduce water velocity and capture sediment on site</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Minimise the amount of material transported from site to surrounding pavement surfaces</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Divert clean water around the site (in accordance with the Landcom/ Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (the Blue Book)).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erosion &amp; sedimentation controls</td>
<td>Erosion and sediment control measures are to be checked and maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard E2</td>
</tr>
<tr>
<td>Erosion &amp; sedimentation controls</td>
<td>• Erosion and sediment control measures are not to be removed until the works are complete and areas are stabilised.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard E3</td>
</tr>
</tbody>
</table>
### Erosion & Sedimentation Control Plan

A progressive erosion and sediment control plan is to be prepared for the works prepared prior to construction and is to include as a minimum:

- Identify site catchment and sub-catchments, high risk areas and sensitive areas
- Sizing of each of the above areas and catchments
- The likely run-off from each sub-catchment
- Separation of on-site and off-site water
- The direction of run-off and drainage points during each stage of construction
- Direction of flow of on-site and off-site water
- The locations and sizing of sediment basins or sumps and associated catch drains and/or bunds
- The locations of other erosion and sediment control measures (e.g., rock check dams, swales and sediment fences)
- Controls/ measures to be implemented on wet weather events
- A mapped plan identifying the above
- A dewatering procedure for onsite water and basins
- A process for reviewing and updating the plan on a fortnightly basis and/or when works alter.

<table>
<thead>
<tr>
<th>Stabilisation</th>
<th>Work areas are to be stabilised progressively during the works.</th>
<th>Contractor</th>
<th>Construction</th>
<th>Core standard safeguard E5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stockpile</td>
<td>The maintenance of established stockpile sites</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core</td>
</tr>
</tbody>
</table>
| sites | during is to be in accordance with the Roads and Maritime Services Stockpile Site Management Guideline (EMS-TG-10).  
| - Controls are to be implemented at exit points to minimise tracking soil and particulates onto pavement surfaces. | |  
| Soil contamination | In the event that indications of contamination are encountered (known and unexpected, such as odorous or visually contaminated materials), work in the area would cease until an contamination assessment can be prepared to advise on the need for remediation or other action, as deemed appropriate. | |  
| Health and safety | Standard health and safety protocols in accordance with Work Cover and NSW Statutory Regulations should be applied during any excavation works in the vicinity of the service station. | Contractor | Construction | Additional safeguard  
| Risk of spills and leaks | Vehicles and machinery should be properly maintained to minimise the risk of fuel/oil leaks. Routine in sections of all construction vehicles and equipment should be undertaken for evidence of fuel/oil leaks.  
| - All fuels, chemicals and hazardous liquids should be stored within an impervious bunded area in accordance with Australian standards and EPA guidelines.  
| - Any on-site refuelling would occur in a designated area with impervious surfaces  
| - Vehicle wash down and/or cement truck washout is to | Contractor | Construction | Additional safeguard |
occur in a designated bunded area and least 50 metres away from water bodies and surface water drains.

- Emergency wet and dry spill kits would be kept on site at all times and all staff would be made aware of the location of the spill kit and trained in its use.
- If an incident (eg spill) occurs, the RMS’s Environmental Incident Classification and Management Procedure is to be followed and the Roads and Maritime Services Contract Manager notified as soon as practicable.
6.3 Traffic and transport

6.3.1 Methodology

The traffic and transport assessment considered the following:

- Impacts of construction activities of the proposal along the corridor
- Impacts of the proposal on travel time and travel speed traffic
- Operational performance of key intersections along the corridor for 2015 and 2025
- Alternative route assessment for the proposed closure of Kenneth Avenue, at Princes Highway
- Oak Road permanent right turn ban from Princes Highway to Oak Road.
- Alternative route assessment for the proposed changes from permanent ban of the right turn movements from Princes Highway at Oak Road.

To assist the assessment of performance of key intersections, traffic modelling was undertaken. Traffic models are used to estimate the number of trips that would be made on a transportation system at a future date as a result of change in the road network (for example, the introduction of a new or upgraded road) or a change in travel demand (for example, the impact of a local development).

Intersection traffic models were developed using SIDRA software. The analysis utilised traffic data and intersection data collected through traffic surveys and validated and calibrated with site observations and SCATS data. The traffic survey was undertaken by Tracsis in September 2015.

SIDRA Analysis modelled intersection improvements resulting from the proposal in terms of improvements to travel time and speed, Delay and Level of Service (LOS) for 2015 and 2025, with and without the proposal.

Overall intersection performance is reported as an estimate of the average delay of all vehicles encounter at a particular intersection; the detailed measure is commonly expressed qualitative as Level of Service which categorises the average delay into bands A to F, with LoS A representing the best operation and LoS F representing the worst operation. The banded categories are defined in Table 6-2.

Table 6-2 Level of Service

<table>
<thead>
<tr>
<th>Level of Service (LoS)</th>
<th>Average delay per vehicle in seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signalised Movements</td>
</tr>
<tr>
<td>A</td>
<td>&lt; 14.5</td>
</tr>
<tr>
<td>B</td>
<td>14.5 to 28.5</td>
</tr>
<tr>
<td>C</td>
<td>28.5 to 42.5</td>
</tr>
<tr>
<td>D</td>
<td>42.5 to 56.5</td>
</tr>
<tr>
<td>E</td>
<td>56.5 to 70.5</td>
</tr>
<tr>
<td>F</td>
<td>&gt; 70.5</td>
</tr>
</tbody>
</table>
As part of assessment, two modelling scenarios were considered:

- 2015 represents the base year
- 2025 represents 8 years since the completion of the upgrade, and provides a 10 year comparison with the proposal from the modelled base year.

An Alternative Traffic Route assessment was prepared by AECOM (Oct, 2016) to present comparisons between the routes that are currently undertaken by surrounding workers and residents, and the alternative routes that would need to be taken with the proposed intersection adjustments. A summary of the report is provided in Section 6.2.3, and a detailed assessment provided in Appendix C.

### 6.3.2 Existing environment

The Princes Highway (A1) connects Wollongong (south bound) to Sydney (north bound). It provides an important access route for traffic, including freight, moving between the south coast, Victoria and the Sydney CBD.

The proposal is located on the Princes Highway and a 150 metre section of the Old Princes Highway between Auburn Street and Acacia Road. For the length of the proposal, the Princes Highway is a six lane highway, with three lanes in each direction and additional turning lanes at Oak Road, Acacia Road and Kingsway intersections. The median varies between one and three metres, increasing to about seven metres near the Kingsway intersection.

Signalised intersections are provided at Acacia Road, Oak Road and Kingsway, including signalised pedestrian crossings at each intersection. The speed limit along the Princes Highway is 70 kilometres per hour and operates under clearway conditions, both north and south bound, between 6am and 10am, 3pm and 7pm Monday to Friday and 10am to 7pm Saturday and Sunday. The Princes Highway south bound is also no parking outside of clearway hours.

#### Traffic Volume

The section of the Princes Highway considered by this proposal carries about 60,000 to 70,000 vehicles per day average daily traffic (ADT) with heavy through movements at the Acacia Road and Oak Road intersections, and a heavy right turn from the Princes Highway into Kingsway. Motorists using this section of the Princes Highway face congestion during morning and evening peak times.

Existing ADT traffic volumes across the project area are provided in Table 6-3.

**Table 6-3 Existing ADT traffic volumes**

<table>
<thead>
<tr>
<th>2015 Base Case</th>
<th>North bound ADT</th>
<th>South bound ADT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Princes Highway (west of Acacia Road)</td>
<td>21,639</td>
<td>25,070</td>
</tr>
<tr>
<td>Princes Highway (between Acacia Road and Kingsway)</td>
<td>36,114</td>
<td>32,092</td>
</tr>
<tr>
<td>Kingsway (east of Princes Highway)</td>
<td>14,148</td>
<td>13,983</td>
</tr>
<tr>
<td>2015 Base Case</td>
<td>North bound ADT</td>
<td>South bound ADT</td>
</tr>
<tr>
<td>Oak Road (from Princes Highway to Waratah Street)</td>
<td>3,534</td>
<td>4,987</td>
</tr>
</tbody>
</table>
Existing corridor performance

The existing operational performance of the study area was assessed using SIDRA 7.0, a traffic analysis tool which provides standard network and intersection performance statistics including travel time, average delay and queue lengths.

The SIDRA model developed for the assessment included the three signalised intersection along the Princes Highway at Acacia Road, Oak Road, and Kingsway. A 2015 Base Case scenario was developed to quantify existing performance of the intersections and formed the basis of comparison for the base (2015) and future (2025) year assessment of the proposal.

Existing intersection performance at Acacia Road, Oak Road and Kingsway was assessed by considering the estimated average vehicle delay, level of service and average speed at the intersections during the morning and evening peak periods.

Table 6-4 summarises the existing morning and evening weekday peak performance of the three key intersections along the Princes Highway for the base year (2015). The base case assessment indicates the key northbound movement during the morning peak hour experiences the greatest level of delay at the intersection of Acacia Rd, with LoS D. Similarly, during evening peak the key southbound movement along Princes Highway experiences the highest level of delay at the Kingsway intersection with LoS F.

Table 6-4 Intersection LoS AM and PM peaks (overall) for the base year (2015)

<table>
<thead>
<tr>
<th>Intersection</th>
<th>AM peak hour traffic</th>
<th>PM peak hour traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Avg Delay</td>
<td>LoS</td>
</tr>
<tr>
<td>Princes Highway / Acacia Road</td>
<td>51.8 sec</td>
<td>D</td>
</tr>
<tr>
<td>Princes Highway / Oak Road</td>
<td>38.3 sec</td>
<td>C</td>
</tr>
<tr>
<td>Princes Highway / Kingsway</td>
<td>29.2 sec</td>
<td>C</td>
</tr>
</tbody>
</table>

In addition to the overall intersection performance, Table 6-5 and Table 6-6 provide estimates of average speed and LoS for the key northbound and southbound movements along the Princes Highway corridor during the peak periods.

Table 6-5 2015 Base Case – Morning peak performance (corridor)

<table>
<thead>
<tr>
<th>Key Intersection</th>
<th>2015 AM Peak – Northbound</th>
<th>2015 AM Peak – Southbound</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Speed</td>
<td>Level of Service</td>
</tr>
<tr>
<td>Princes Highway / Acacia Road</td>
<td>25.7 km/hr</td>
<td>C</td>
</tr>
<tr>
<td>Princes Highway / Oak Road</td>
<td>29.4 km/hr</td>
<td>C</td>
</tr>
<tr>
<td>Princes Highway / Kingsway</td>
<td>47.4 km/hr</td>
<td>B</td>
</tr>
</tbody>
</table>

Consistent with the estimates of overall intersection performance, the travel speeds and level of service results indicate vehicles experience the greatest detail at the Acacia Road intersection. Whilst the results for the northbound movement at Acacia Road indicate it operates at LoS C, the priority allocated to the key movement impacts the
performance of the southbound approach, particularly the through movement from Princes Highway to Old Princes Highway.

Table 6-6 2015 Base Case – Evening peak performance (corridor)

<table>
<thead>
<tr>
<th>Key Intersection</th>
<th>2015 PM Peak – Northbound</th>
<th></th>
<th>2015 PM Peak – Southbound</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Speed</td>
<td>Level of Service</td>
<td>Average Speed</td>
<td>Level of Service</td>
</tr>
<tr>
<td>Princes Highway / Acacia Road</td>
<td>19.6 km/hr</td>
<td>E</td>
<td>46.6 km/hr</td>
<td>B</td>
</tr>
<tr>
<td>Princes Highway / Oak Road</td>
<td>28.8 km/hr</td>
<td>C</td>
<td>32.2 km/hr</td>
<td>C</td>
</tr>
<tr>
<td>Princes Highway / Kingsway</td>
<td>42.5 km/hr</td>
<td>B</td>
<td>7.0 km/hr</td>
<td>F</td>
</tr>
</tbody>
</table>

The southbound Princes Highway movement experiences the greatest delay at the Kingsway intersection. The SIDRA model estimates the average travel speed at 7.0 km/hr with a LoS F. The performance of the southbound movement is impacted by the conflicts with the right turn movements into and out of Kingsway. Similar to the morning peak results, the Acacia Road intersection experiences delay with a LoS E in the counter peak direction (northbound), this is consistent with the priority allocated to the southbound movements (left and through) on Princes Highway.

Future Traffic Growth

Future background traffic growth along the Princes Highway within the Kirrawee study area is expected to be influenced by the following factors:

- Development of land uses within the study area
- Development of land uses and infrastructure upgrades outside the study area, which may influence vehicle routes and demand along Princes Highway, Kingsway and Old President Avenue.

For the purpose of the traffic assessment, the proposal was assessed for the 2015 base year and 2025 which incorporates anticipated levels of background traffic growth. To facilitate the future year assessment, a combination of the committed developments within Kirrawee and the Sydney Strategic Traffic Forecasting Model (STFM) was used to calculate the growth factors from 2015 to 2025.

The STFM outputs are based on the latest available planning data for Sydney and incorporate factors such as future travel behaviour changes and vehicle travel pattern changes in response to infrastructure upgrades. The STFM outputs were considered the best available source of strategic traffic information for the assessment.

Proposed road closures (including travel routes to be modified)

The area that would be primarily affected by the banning of the right turn movements from Princes Highway into Oak Road and the closure of Kenneth Avenue is a region of approximately 60 hectares bounded by Waratah Street, Acacia Road, President Avenue, the Eastern Suburbs and Illawarra Railway Line (T4) and Bath Road (refer to Figure 6-9 and Figure 6-10). Right turn bans are already in place for the contra peak directions (west to north banned AM, east to south banned PM), the proposal extends the temporary bans to permanent.
Figure 6-9 Affected areas
This area can be split into four regions separated by Oak Road and Princes Highway as shown in Figure 6-10.
Region 1 consists mainly of residential housing (about 210 dwellings) with the exception of the Four Square Stores (Food Retail) located at the south eastern corner of the Waratah Street and Acacia Road intersection and the Kirrawee bowling and recreation club located at 101 Oak Road, Kirrawee.

Region 2 is predominantly an industrial and commercial area. Region 3, north of Flora Street consists mainly of residential apartments and the Donald Robinson Retirement Village. A BP Service Station is located at the corner of Princes Highway and Oak Road. South of Flora Street, Region 3 consists of residential housing as well as some apartments and townhouses. The Fauna Place Child Care centre is located at Lot 30, Fauna Place, Kirrawee. A number of local stores and restaurants (Kirrawee Shopping Centre) are located along Oak Road south of Flora Street and north of the railway line. The Australia Post – Kirrawee branch is also located within the Kirrawee Shopping Centre.

Region 4 is predominantly an industrial and commercial area. A new development, “South Village” Kirrawee, is currently proposed in the northwest area of this region (current brickpit site). The development is currently under construction and will consist of residential apartments, restaurants, cafes, Aldi and Coles supermarkets, undercover parking and retail stores. South of Flora Street and north of the T4 railways line, Region 4 contains the Oak Road local stores to the west (Kirrawee Shopping Centre). A church is located in this area as well as the Kirrawee Railway Station. The rest of Region 4, east of the new development and south of Flora Street, consists of a number of industrial stores / businesses. An assessment of alternative routes under the proposal is provided in Section 6.2.3.

**Pedestrian movements**

The following existing pedestrian facilities exist:

- An existing three approach signal controlled pedestrian crossing connects to the concrete traffic island currently closing Acacia Road for south bound vehicles
- The existing Oak Road intersection facilitates a four approach signal controlled pedestrian crossing
- The existing eastern approach of the Kingsway / Princes Highway intersection provides a two approach signal controlled pedestrian crossing facility.

A description of proposed upgrades is included in Section 6.2.3.

**Parking**

There is an existing ‘No Stopping’ zone along Kingsway eastbound for about 70 metres from Princes Highway. There is an additional ‘No Stopping’ zone beginning 40 metres from Hotham Road, ending at Hotham Road.

In accordance with NSW road rules, vehicles are prohibited from stopping within 10 metres of the intersection of Kingsway with Foch Avenue. They are also prohibited from stopping on or within 20 metres before a bus stop.

In addition, there are existing ‘No Stopping’ and ‘No Parking’ zones at the intersection of Foch Avenue with the local access road running along Kingsway eastbound.

There are currently no parking restrictions on Foch Avenue and Hotham Road.
Parking is permitted in nearby residential areas. There are no commercial properties in the area to be impacted by the proposed parking restrictions.

**Public transport**

Various bus routes travel through the proposal area as well as the local road network where the compound sites are located (refer to Section 2.2.5). These routes are operated by Transdev and include around 15 routes. Bus routes travel through the proposal in both north bound and south bound directions, however there are no bus stops on the Princes Highway for the length of the proposal.

Figure 2-7 and Figure 2-8 display the various routes throughout Kirrawee and broader council area.

### 6.3.3 Potential impacts

**Construction**

**Construction phasing**

Temporary traffic capacity reductions would be required in order to install traffic safety barriers between live traffic lanes and the construction site. The following temporary lane reductions/closures are considered typical for a proposal of this size to facilitate construction activities:

- **Day time works:**
  - Two live lanes in each direction along Princes Highway (reduced from generally three live lanes)
  - Single live lanes on Oak Road north (reduced from two live lanes).

- **Night time works:**
  - One live lane in each direction along Princes Highway (reduced from generally three live lanes)
  - Oak Road north restricted access (reduces from two live lanes).

Table 6-7 provides indicative construction activities considered suitable to deliver the proposal at the time of preparing the REF. Final construction phasing and day/night activities would be determined by the construction contractor in association with Roads and Maritime, and would be confirmed prior to construction.

Table 6-7 Indicative construction activities (day and night work)

<table>
<thead>
<tr>
<th>Day/night</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day/night</strong></td>
<td>Day time and night time works, utilities diversion works including the proposed utilities corridor under the proposed shared surface service road parallel to Princes Highway (north side) between Acacia Road and Oak Road</td>
</tr>
<tr>
<td><strong>Day</strong></td>
<td>Day time works, construction and surfacing of the shared surface service road</td>
</tr>
<tr>
<td><strong>Night</strong></td>
<td>Night time works, concrete pavement widening into the existing median on Princes Highway in the vicinity of Auburn Street</td>
</tr>
</tbody>
</table>
Day | Day time works, retaining wall installation between Princes Highway and the shared surface service road including placement of the timber LV electrical poles and landscaping at the foot of the retaining wall on the shared surface service road side

Day | Day time works, widening of existing north bound asphalt pavement on Princes Highway to the north verge along the entire scheme. Including widening of existing asphalt pavement of Oak Road north

Day | Day time works, Princes Highway south bound to Kingsway left turn lane

Night | Night time works, traffic island modifications in the vicinity of Princes Highway to Kingsway left turn lane

Night | Night time works, traffic island modifications in the vicinity of Old Princes Highway / Acacia Road South

Day | Day time, asphalt pavement widening into existing median and median and median modification works scheme wide (with the exception of Phase 3)

**Road work**

During construction, additional vehicle movements would be generated along the Princes Highway, Acacia Road, Oak Road, and Kingsway within the proposal area. These movements would generally be along the Princes Highway and between the construction compound on Kingsway (refer to Figure 3-16) and construction areas.

Heavy vehicle traffic would mainly be generated by activities associated with the following:

- delivery of construction materials
- spoil removal
- delivery and removal of construction equipment and machinery
- movement of construction personnel, including contractors, site labour force and specialist supervisory personnel.

Construction of the proposal would be undertaken using standard road project construction techniques. Typical plant and equipment that may be used during construction is outlined in Section 3.3.3.

It is expected that the majority of construction activities, such as excavation, concrete works and delivery of construction materials, would occur outside of standard construction hours. This would minimise traffic disruptions for peak period commuters.

After hours deliveries to businesses throughout the corridor (predominantly located between Oak Road and Kingsway - refer to Section 6.3.2) may be affected by the presence of construction activities. Based on the general type of businesses present in this location and the availability of loading docks or parking in nearby side streets, the impact is expected to be minor and would be limited to temporary access restrictions at sites of construction works along the proposal area. Consultation would be undertaken with all affected businesses to establish those that may be affected and to organise construction so as to minimise overall impacts upon their operation.

Up to twenty-six heavy vehicles would be required per day, resulting in about 52 to 100 heavy vehicle movements in and out of the proposal area per day during peak
construction phases. These heavy vehicle movements are likely to be spread through the night work time period. The movement of materials would be managed through the scheduling of deliveries and availability of fleet, and would aim to minimise the number of haulage and delivery vehicles required during peak periods and weekends.

Construction vehicles would access the site via arterial roads wherever possible (refer to Figure 3-16). Given that these roads already carry high volumes of traffic (up to 36,000 vehicles per day each way within the proposal area) it is not anticipated that the proposal would result in a high degree of impact above what is currently experienced. Additional construction traffic would be well within the range of daily variation in traffic on these routes. To minimise impacts upon the local road network, heavy vehicle traffic would use the regional road network, Princes Highway and Kingsway, and the local road network for access routes to and from construction areas (refer to Figure 3-16).

Disruption to existing property access would be minimised and would only be undertaken following consultation with individual property owners/occupiers affected by the works (refer to Figure 6-11).

Light vehicle traffic would be generated by staff movements to and from the construction compound to the construction site(s) along the Princes Highway. Staff would typically comprise of project managers, various trades, and general construction personnel. Light vehicles used to transport staff to and from zones would be parked on nearby local streets or in public car parks during active work periods. The traffic generated from construction light vehicles generally is likely to result in increases of up to 20 vehicles per hour in the AM and PM peak periods, which is well within the daily variation traffic on the road network.

Access for emergency vehicles along Princes Highway and Kingsway, and on relevant side roads would be maintained in accordance with emergency vehicle requirements. Emergency services would be advised of all planned changes to traffic arrangements prior to their implementation.

Overall, provided the proposed traffic management measures are implemented, the likely impact upon local traffic during construction is expected to be manageable and would not have a major impact on the performance or capacity of the surrounding road network.

**Access**

Access to some properties would be temporarily impacted by construction of the proposal. Properties impacted by construction works are shown in Figure 6-11.

Should Roads and Maritime Services proceed with the Proposal, consultation activities would continue up to and during construction. In particular, consultation activities would be undertaken with directly impacted community stakeholders to assist in managing access and other impacts during construction.
**Pedestrians**

During construction, there is the potential for temporary disruptions to the existing pedestrian facilities (including paths and signalised road crossings) along the Princes Highway, as well as on surrounding local roads. This has the potential to increase safety risks for pedestrians due to possible interactions with construction plant and vehicles.

There would be temporary disruptions to pedestrian access for crossings on the north bound side of the Princes Highway at the locations of:

- Acacia Road intersection
- Service road between Acacia Road and Oak Road
- Oak Road intersection
- Between Oak Road and Kingsway
- Kingsway intersection.

All existing pedestrian crossings and footpaths would be maintained for the duration of the construction period. There is potential for some footpath impacts to occur during construction. If footpaths are impacted, alternative paths would be established to ensure safe passage of pedestrians through the proposal area.

**Operation**

**Road Corridor Performance**

The performance of the road network for 2015 and 2025 was assessed using the network function of the SIDRA model for Princes Highway intersections at Acacia Road, Oak Road and Kingsway.

The assessment estimated the operational performance of the network under 2015 and 2025 traffic demands for with and without proposal scenarios. The future year 2025 assessment assumed growth forecast by the Sydney Strategic Traffic Forecasting Model (STFM).

The assessment assumed the morning and evening peak hour demands change in response to wider network changes.
Table 6-8 summarises the total intersection demands, and the average yearly traffic growth expected at each intersection. As part of the operational assessment, specific growth rates were applied by individual turning movement to capture the changes in travel patterns at each intersection.
Table 6-8 Base and Future year total intersection demands

<table>
<thead>
<tr>
<th>Intersection</th>
<th>AM Peak</th>
<th></th>
<th></th>
<th>PM Peak</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2015 Demand (veh /hr)</td>
<td>2025 Demand (veh /hr)</td>
<td>Average Yearly Growth</td>
<td>2015 Demand (veh /hr)</td>
<td>2025 Demand (veh /hr)</td>
<td>Average Yearly Growth</td>
</tr>
<tr>
<td>Princes Highway / Acacia Road</td>
<td>5,437</td>
<td>6,480</td>
<td>+1.9%</td>
<td>6,281</td>
<td>6,762</td>
<td>+0.8%</td>
</tr>
<tr>
<td>Princes Highway / Oak Road</td>
<td>5,536</td>
<td>6,696</td>
<td>+2.1%</td>
<td>6,308</td>
<td>7,411</td>
<td>+1.7%</td>
</tr>
<tr>
<td>Princes Highway / Kingsway</td>
<td>5,602</td>
<td>6,401</td>
<td>+1.4%</td>
<td>6,466</td>
<td>7,129</td>
<td>+1.0%</td>
</tr>
</tbody>
</table>

The forecasts estimate the Princes Highway / Oak Road intersection at the centre of the study area experiences the greatest increase in peak hour traffic demand, with 2.1 per cent and 1.7 per cent during the AM and PM peak respectively. The higher growth rates at Oak Road intersection are consistent with the anticipated development to occur within Kirrawee.

**Comparative Assessment**

The SIDRA assessment was also used to predict the change in average delay, travel speed and LoS along Princes Highway, at Acacia Road, Oak Road and Kingsway to assess the overall change to the local road network.

The SIDRA assessments were undertaken for the peak one-hour periods in the morning and evening. The series of three intersections were assessed and modelled as a single network of intersections to capture potential impact of queuing and signal coordination.

The traffic assessment of the with and without project scenarios for base (2015) and future (2025) years examined travel speeds, average delay and level of service.
Table 6-9 and II change to the road network.

Table 6-12, summarise the results of the traffic assessment for the AM and PM peaks for the following scenarios:

- Base Year (2015)
- 2015 With Proposal
- 2025 Do Nothing
- 2025 With Proposal.
The SIDRA outputs show that overall Level of Service is expected to improve at intersection along the Princes Highway during the peak periods. Under the 2015 base case traffic demands, all three intersections are expected to experience reductions in average delay, with the greatest improvements observed at the sites with the highest level of delay, namely Princes Highway / Acacia Road (AM peak) and Princes Highway / Kingsway (PM Peak).

Traffic demands remain consistent for the comparison between the 2015 base case and with proposal scenarios, with the improvements the result of infrastructure and the traffic signal operation changes, particularly at the Princes Highway / Oak Road intersection.

The performance improvements to the key northbound and southbound Princes Highway movements during the peak periods is summarised in Table 6-10 and Table 6-11. Consistent with the individual intersection assessment, the estimated peak hour average speeds along the Princes Highway corridor are expected to improve along Princes Highway with the proposal.

Table 6-10 2015 AM Comparison of peak performance (corridor)
### Table 6-11 2015 PM Comparison of peak performance (corridor)

<table>
<thead>
<tr>
<th>Key Intersection</th>
<th>2015 Base Case</th>
<th>2015 With Proposal</th>
<th>Improvement</th>
<th>2015 Base Case</th>
<th>2015 With Proposal</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Speed (km/hr)</td>
<td>Average Speed (km/hr)</td>
<td>Average Increase (km/hr)</td>
<td>Average Speed (km/hr)</td>
<td>Average Speed (km/hr)</td>
<td>Average Increase (km/hr)</td>
</tr>
<tr>
<td>Princes Highway / Acacia Road</td>
<td>19.6</td>
<td>22.4</td>
<td>2.8</td>
<td>46.6</td>
<td>52.0</td>
<td>5.4</td>
</tr>
<tr>
<td>Princes Highway / Oak Road</td>
<td>28.8</td>
<td>41.7</td>
<td>12.9</td>
<td>32.2</td>
<td>41.1</td>
<td>8.9</td>
</tr>
<tr>
<td>Princes Highway / Kingsway</td>
<td>42.5</td>
<td>44.5</td>
<td>2.0</td>
<td>7.0</td>
<td>27.7</td>
<td>20.7</td>
</tr>
</tbody>
</table>

The Proposal is anticipated to improve base year (2015) intersection performance for both AM and PM peak periods. A summary of the intersection improvements and discussion on the potential reduction in delays experienced by motorists is provided below for each intersection.
**Acacia Road / Princes Highway**

*2015 with Proposal*

With the proposed works along Princes Highway, the intersection is expected to improve from LoS D to LOS C during the AM peak, with reduced overall intersection delay. The greatest volume movement, the right turn from Acacia Road (with over 1,770 vehicles in the AM peak), improves for LoS C to LoS B under the proposal.

The proposal to provide additional through lane capacity along Princes Highway would improve the overall intersection performance in the PM peak. These improvements allow green time to be reallocated at the intersection to reduce the delays for the major intersection movements, namely the southbound through and left turn from Princes Highway, and the northbound right turn from Acacia Road.

**Oak Road / Princes Highway**

*2015 with Proposal*

With the proposal the overall performance of the intersection is forecast to improve with a reduction in average delay. The intersection benefits from the additional through lanes on the major Princes Highway approaches and the introduction of diamond traffic signal phasing from Oak Road.

With the changes proposed at the intersection, the overall intersection performance is forecast to improve from LoS C to LoS B in both morning and evening peak periods. The improvement to the AM peak is demonstrated by the estimated reduction in delay of 40% (LoS C (28.8 sec) to LoS B (17.0 sec)) for the major Princes Highway northbound movement which is in the order of 3,000 vehicles in the peak hour. Similar improvements are expected during the PM peak with the major southbound movement (~3,000 vehicles) improving from LoS C to LoS B.

The traffic assessment indicates the performance of the Oak Road approaches is expected to improve under the proposal, with the exception of the northern approach during the PM peak. However the relatively low peak hour demand (~ 250 vehicles) on this north approach indicates the delay is negligible.

**Kingsway / Princes Highway**

*2015 with Proposal*

With the proposal, the overall intersection is forecast to improve in performance from LoS C to LoS B during the AM peak. The additional of a third right turn lane from Princes Highway to Kingsway has allowed reallocation to the traffic signal phasing to favour the Princes Highway corridor, in particular the southbound through movement.

The proposal is estimated to have the greatest improvement on overall intersection performance during the PM peak when the southbound through movement is the highest demand. Under the proposal, the assessment estimates the reallocation of green time...
will result in the Level of Service for the major southbound movement improving from LoS F to LoS B.

**Future Year assessment (2025)**

The SIDRA assessment was also used to predict the future performance of the Princes Highway under a 2025 Do Nothing and a 2025 with proposal scenario. The Do Nothing scenario maintains the existing intersection layouts, with only minor changes to signal operation in response to the expected increase in traffic growth (refer to
Table 6-9).

The investigation of the future year scenario examined the impact of traffic growth and development of the average delay, travel speed and LoS along Princes Highway, at Acacia Road, Oak Road and Kingsway to assess the overall change to the road network.

Table 6-12 2025 Do Nothing comparison to With Proposal

<table>
<thead>
<tr>
<th>Intersection by Approach</th>
<th>2025 AM Peak</th>
<th>2025 PM Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Do Nothing</td>
<td>With Proposal</td>
</tr>
<tr>
<td>Princes Highway / Acacia Road</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Old Princes Highway</td>
<td>D</td>
<td>C</td>
</tr>
<tr>
<td>Acacia Road</td>
<td>F</td>
<td>C</td>
</tr>
<tr>
<td>Princes Highway</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Overall Intersection</td>
<td>F</td>
<td>D</td>
</tr>
<tr>
<td>Int. Average Delay</td>
<td>329</td>
<td>50.7</td>
</tr>
<tr>
<td>Princes Highway / Oak Road</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Princes Highway (W)</td>
<td>C</td>
<td>A</td>
</tr>
<tr>
<td>Oak Road (S)</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Princes Highway (E)</td>
<td>D</td>
<td>A</td>
</tr>
<tr>
<td>Oak Road (N)</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Overall Intersection</td>
<td>F</td>
<td>B</td>
</tr>
<tr>
<td>Int. Average Delay</td>
<td>158.8</td>
<td>17.9</td>
</tr>
<tr>
<td>Princes Highway / Kingsway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Princes Highway (S)</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>Kingsway</td>
<td>F</td>
<td>D</td>
</tr>
<tr>
<td>Princes Highway (N)</td>
<td>C</td>
<td>B</td>
</tr>
<tr>
<td>Overall Intersection</td>
<td>C</td>
<td>B</td>
</tr>
<tr>
<td>Int. Average Delay</td>
<td>32.5</td>
<td>24.2</td>
</tr>
</tbody>
</table>

The future year traffic assessment of the Do Nothing scenario indicates the intersections will deteriorate under the expected traffic growth. Consistent with the base case scenario, the Princes Highway intersections at Acacia Road and Oak Road experience the greatest level of delay during the morning peak period. Similarly, the dominant southbound evening peak demand results in deterioration of performance along the Princes Highway at Kingsway and Oak Road.

The traffic assessment of the 2025 With Proposal scenario indicates the upgrades would allow the corridor to perform at an improved level of services despite the increase in traffic demand. As shown in II change to the road network.

Table 6-12, the Princes Highway / Acacia Road intersection demands are forecast to increase from ~5,500 vehicles to ~6,700 vehicles during the AM peak, however despite the substantial increase the upgrades are expected to improve the overall performance.
of the intersection and maintain a LoS D. The morning peak hour assessment of Princes Highway intersections at Kingsway and Oak Road likewise show an improvement in performance under the forecast traffic growth.

The Princes Highway intersection at Kingsway is expected to be impacted by 2025. The outputs show the LoS is forecast to improve from LoS F to LoS B, primarily due to the addition of the third right turn lane allowing reallocation of green time to the major southbound Princes Highway movement. The evening peak hour assessment of Princes Highway intersections at Acacia Road and Oak Road likewise show an improvement in performance under the forecast traffic growth.

The forecast performance improvements to the key northbound and southbound Princes Highway movements for future year scenarios are summarised in Table 6-13 and Table 6-14. Consistent with the base year comparison, the estimated peak hour average speeds along the Princes Highway corridor are expected to improve along Princes Highway with the proposal.

Table 6-13 2025 AM Comparison of peak performance (corridor)

<table>
<thead>
<tr>
<th>Key Intersection</th>
<th>2025 AM Peak – Northbound</th>
<th>2025 AM Peak – Southbound</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2025 Do Nothing</td>
<td>2025 With Proposal</td>
</tr>
<tr>
<td></td>
<td>Average Speed (km/hr)</td>
<td>Average Speed (km/hr)</td>
</tr>
<tr>
<td>Princes Highway / Acacia Road</td>
<td>2.5</td>
<td>26.2</td>
</tr>
<tr>
<td>Princes Highway / Oak Road</td>
<td>26.8</td>
<td>47.5</td>
</tr>
<tr>
<td>Princes Highway / Kingsway</td>
<td>43.3</td>
<td>49.4</td>
</tr>
</tbody>
</table>
Table 6-14 2025 PM Comparison of peak performance (corridor)

<table>
<thead>
<tr>
<th>Key Intersection</th>
<th>2025 PM Peak – Northbound</th>
<th>2025 PM Peak – Southbound</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2025 Do Nothing</td>
<td>2025 With Proposal</td>
</tr>
<tr>
<td>Princes Highway / Acacia Road</td>
<td>Average Speed (km/hr)</td>
<td>5.6</td>
</tr>
<tr>
<td>Princes Highway / Oak Road</td>
<td>Average Speed (km/hr)</td>
<td>25.7</td>
</tr>
<tr>
<td>Princes Highway / Kingsway</td>
<td>Average Speed (km/hr)</td>
<td>40.1</td>
</tr>
</tbody>
</table>

The Proposal is anticipated to improve future year (2025) intersection performance for both AM and PM peak periods. A summary of the intersection improvements and discussion on the potential reduction in delays experienced by motorists is provided below for each intersection.

**Acacia Road / Princes Highway**

**2025 Do Nothing**

Traffic growth at the intersection during the 2025 AM peak is mainly limited to the right turn movement from Acacia Road onto Princes Highway (over 600 vehicles added to the existing 1,750), and the increase to the southbound demand on Princes Highway continuing through to Old Princes Highway. This is forecast to result in a deterioration of the intersection performance to LOS F (from the current base of LOS D), with an expected increase in average delay.

Traffic growth at the intersection is less significant during the PM peak when compared to the AM peak, with approximately 200 vehicle demand increase for right turn from Acacia Road to Princes Highway. Despite the moderate traffic growth, this intersection is forecast to deteriorate to LoS F under the 2025 Do Nothing scenario.

**2025 with Proposal**

The future year assessment indicates that despite substantial growth during the morning peak periods, the Princes Highway / Acacia Road intersection will continue to operate at LoS D, an improvement over the 2015 base case. The duplication of the right turn from Old Princes Highway and the additional through lane from Princes Highway to Old Princes Highway has provided additional intersection capacity and allowed reallocation of green time to accommodate the future demand.
Whilst the forecast evening peak traffic growth is moderate, the Proposal upgrades are expected to improve the forecast level of service from LoS F to LoS C, largely due to the reduction in delay for the northbound movement from Acacia Road to Princes Highway from greater green signal phase time and additional capacity on the Princes Highway (eastern approach of the intersection, travelling southbound).

**Oak Road / Princes Highway**

**2025 Do Nothing**

The Princes Highway / Oak Road intersection is forecast to experience the greatest growth in traffic of the three key intersections assessed. In addition to the growth on Princes Highway, the 2025 forecast includes growth on Oak Road approach which is consistent with the ongoing development adjacent to Kirrawee town centre. The existing layout and signal phasing deteriorate under the combination of growth on Oak Road and Princes Highway to performance at LoS F during both peak periods.

In addition, the future traffic assessment indicates the full extent of southbound demand during the PM peak is constrained upstream at Princes Highway / Kingsway intersection. As a result the forecast performance of the PM peak Do Nothing scenario may further deteriorate if the upstream constraint was removed.

**2025 with Proposal**

With the upgrade, the intersection is forecast (2025) to improve to LOS B in the AM peak and LoS C in the PM peak. The assessment indicates the key northbound and southbound movements along Princes Highway improve to LoS A and LoS B, for the AM and PM peak respectively.

The forecasts indicate the substantial increase to the intersection capacity and adopting the diamond phasing improves the performance of the intersection and allows for the increased demand from Oak Road. The traffic assessment indicates an improvement of PM peak from LoS F to LoS E on the Oak Road (Sth) despite the forecast average increase in demand of 500 vehicles (325 veh to 825 veh).

**Kingsway / Princes Highway**

**2025 Do Nothing**

The Princes Highway / Kingsway intersection is forecast to operate at an overall LoS C during the AM peak and LoS F during the PM peak. The traffic growth is forecast to increase under the proposal, however the constrained performance of the upstream network (Acacia Rd and Oak Rd) have limited the deterioration in performance of the AM peak.

During the PM peak, the Do Nothing scenario is expected to deteriorate to LoS F, with extensive queueing and delay expected to the major southbound Princes Highway movement.
**2025 with Proposal**

With the upgrade, the intersection is forecast (2025) to improve to LOS B in the AM peak and LoS C in the PM peak. The addition of the third right turn lane provides capacity improvement to both peak periods as it allows for green time to be reallocated to the major Princes Highway corridor, this is particularly evident in PM peak where the southbound movement improves from a forecast LoS F to LoS C.

**Alternative route assessment**

The Alternative Route Study (refer to Appendix C) (AECOM 2016) presents comparisons between the routes that are currently undertaken by surrounding workers and residents, and the alternative routes that would need to be taken following construction of the proposal.

Figure 6-10 identifies four regions which as assessed in the Alternative Routes Stude. Figure 6-12 below identifies the shortest and quickest alternative route (as identified by the AECOM study), for right turning vehicles from Princes Highway (southbound) into Oak Road (northern approach).

Based on the outcomes of the Alternative Route assessment, the following conclusions are drawn on the impact to local workers and residents with the proposal:

- Banning the right turn from Princes Highway (south bound) into Oak Road (refer to Figure 3-4)
  - AM and PM peak traffic counts were undertaken (8 November 2016) to quantify the number of vehicles that would be required to take an alternative route under the proposal through the banning of the right turn from Princes Highway (south bound) into Oak Road. One vehicle made this turn in the AM peak on 8 November 2016 due to the existing AM peak turning restrictions at the intersection. A total of 32 vehicles turn right from Princes Highway (south bound) into Oak Road in the PM peak when no restrictions are in place
  - With the exception of Auburn Street which is a primary access road to Sutherland North Public School, the rest of the local roads have sufficient capacity to handle the potential increase in traffic
  - Three of the alternative routes considered to access Regions 1 and 2 (affected by the banning of the right turn) are shorter than the assumed original route which utilises the right turn
  - The longer alternative route increase travel time by a maximum of three minutes (without traffic), this is shown in Figure 6-12
  - As the right turn is not permitted between the hours of 6AM and 10AM Monday to Friday it is likely that the local traffic is already aware of the alternative routes
  - Based on this assessment and the above conclusions, it is reasonable to ban the right turn from Princes Highway (south bound) into Oak Road.
Permanent removal of right turn movements from Princes Highway to Oak Road
Figure 6-10 identifies four regions which as assessed in the Alternative Route Study. Figure 6-13 below identifies the shortest and quickest alternative route (as identified by the AECOM study), for right turning vehicles from Princes Highway (northbound) into Oak Road (southern approach).

- Banning the right turn from Princes Highway (north bound) into Oak (refer to Figure 3-4)
  - Right turn bans are already in place for the contra peak directions (banned PM peak), the proposal extends the temporary bans to permanent
  - AM and PM peak traffic counts were undertaken (8 November 2016) to quantify the number of vehicles that would be required to take an alternative route under the proposal through the banning of the right turn from Princes Highway (north bound) into Oak Road. A total of 155 vehicles turn right from Princes Highway (north bound) into Oak Road in the AM peak. No vehicles make this turn in the PM peak due to existing turning restrictions at the intersection
  - Banning the right turn from Princes Highway (north bound) into Oak Road would direct traffic onto the surrounding roads including Acacia Road, President Avenue, Waratah Street, Kingsway, Hotham Road, Clements Parade, Flora Street, Durbar Avenue and Bath Road
  - The roads appear to have sufficient capacity to take additional traffic if required however banning this turn means that the traffic would most likely utilise President Avenue and Oak Road to access Regions 3 and 4. The alternative routes run through the Kirrawee Shopping Centre located on Oak Road which is already a busy road with local shops, restaurants, train station and an education centre
  - All alternative routes increase travel time however the maximum increase in time is three minutes, this is shown in Figure 6-13
  - As the right turn is not permitted between the hours of 6AM and 10AM Monday to Friday it is likely that the local traffic is already aware of the alternative routes
  - Based on this assessment and the above conclusions, it is reasonable to ban the right turn from Princes Highway (north bound) into Oak Road.
Permanent removal of right turn movements from Princes Highway to Oak Road

Alternative routes for right turn from Princes Highway (north bound) into Oak Road (southern approach)  

Fig. 6.13

Vector backdrop data © MDS 2017, public_NSW_Imagery: © Land and Property Information 2015

Last updated by: DW13219 on 18/05/2017 at 16:52
• Closing Kenneth Avenue presented in Figure 6-14
  – AM and PM peak traffic counts were undertaken (8 November 2016) to quantify the number of vehicles that would be required to take an alternative route under the proposal through the proposed closure of Kenneth Avenue at Princes Highway. A total of 23 and 32 vehicles entered Kenneth Avenue from Princes Highway in the AM peak and PM peak respectively. A total of 8 and 11 vehicles turned left to the Princes Highway (north bound) from Kenneth Avenue during the AM and PM peak respectively
  – Closing Kenneth Avenue to Pacific Highway would direct traffic to utilise Gilmore Avenue, Peach Tree Lane, Acacia Road and Waratah Street
  – While Acacia Road and Waratah Street have sufficient capacity to accommodate the potential increase in traffic, Gilmore Avenue and Peach Tree Lane are very narrow residential streets. Nonetheless, Gilmore Avenue and Peach Tree Lane would be only used to access the properties fronting the property access road, 23 dwellings in total. The increase in traffic is considered to be negligible given these properties can also be accessed from other routes
  – The alternative routes increase travel times by only one minute
  – The alternative routes considered for the reverse movements i.e. back onto Princes Highway are slightly longer than the current movements increasing travel time by one to three minutes
  – Maintaining the intersection leads to safety concerns with vehicles on Princes Highway slowing down to turn left. In addition, maintaining the intersection leads to visibility and tie-in issues with the high gradient between Princes Highway and Kenneth Avenue, and the need for a retaining wall. Furthermore a number of turning paths cannot be satisfied for the Princes Highway to property access movement via Kenneth Avenue
  – Based on this assessment and the above conclusions, it is considered reasonable to close the Kenneth Avenue / Princes Highway intersection as suitable alternatives are available.

Figure 6-12 to Figure 6-14 identifies the shortest alternative route for impacted movements, including identification of the assumed original route and assumed destinations. Additional alternative routes, including travel time changes resulting from the proposal, is provided in Appendix C.
Kenneth Avenue Closure from Pacific Highway (north bound)

LEGEND
- Origin/destination
- Assumed original route
- Proposal
- Alternative route to:
  - Destination 1
  - Destination 2

Fig. 6.14

Vector backdrop data © MDS 2017, public_NSW_Imagery: © Land and Property Information 2015
Last updated by: DW13219 on 19/05/2017 at 9:28
Parking restrictions

Roads and Maritime propose to install “No Parking” across the blue shaded zones (impacted length) shown in Figure 6-15, the eastbound carriageway on the Kingsway.

The length of parking to be removed is about 76 metres. Assuming a parallel parking space of length 6.3 metres (in accordance with AS 2890.5-1993), a total of 12 parking spaces are proposed to be removed.

Figure 6-15 Existing and impacted parking

From site inspections, the residential properties located adjacent to the location of assessment (facing onto the Kingsway) have off-street parking facilities available in the form of garages, undercover carports, and driveways.

Due to Kingsway being a Roads and Maritime state owned road (highway or main traffic route), and the availability of off street and on street available parking for residences, the implementation of a formal No Stopping in the area shown in Figure 6-15 is considered to have negligible impacts. This also negates the need for parking directional signage.

Unrestricted parking is available within the local access road (parallel with the Kingsway) adjacent to the location of assessment, and also within the length of Foch Avenue and within Hotham Road.
Pedestrian movements

The proposal includes a range of upgrades to existing pedestrian facilities, as well as the provision of an additional crossing, new kerbside ramps, new footways (between 2.4 metres to 4.5 metres wide), and an upgrade of the shared zone for the Princes Highway service road (including landscaping).

The following pedestrian facilities would be upgraded under the proposal:

- The Oak Road intersection will facilitate a signal controlled pedestrian crossing on all approaches
- The Kingsway / Princes Highway intersection will provide a new staggered pedestrian crossing on Princes Highway northern approach
- Relocated and upgraded footway from the corner of Oak Road (north bound) to the McDonalds access road.
### 6.3.4 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access during construction</td>
<td>- Current traffic movements and property accesses are to be maintained during the works. Any disturbance is to be minimised to prevent unnecessary traffic delays and businesses/residences informed.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard T1</td>
</tr>
<tr>
<td>Access during construction</td>
<td>- Safe pedestrian access around the work site would be provided by the construction contractor and captured within the traffic management plan</td>
<td></td>
<td></td>
<td>Additional safeguard</td>
</tr>
<tr>
<td></td>
<td>- The parking of light construction vehicles (eg staff vehicles) would be restricted to designated areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Consultation with emergency service authorities would be undertaken during development of the detailed design including NSW Rural Fire Service and Fire Rescue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction traffic impacts</td>
<td>A construction Traffic Management Plan (TMP) would be prepared and implemented by the Construction Contractor, included in the Construction Environmental Management Plan (CEMP).</td>
<td>Construction contractor</td>
<td>Prior to construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td></td>
<td>The construction TMP would be the primary management tool to manage potential traffic and pedestrian impacts associated with construction. The construction TMP, at a minimum, would include:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
<td>----------------------</td>
<td>----------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td></td>
<td>• confirmation of haulage routes including investigation of alternate routes to minimise use of local roads</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pedestrian and cycle provisions throughout the construction period</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Outline of the consultation process to inform the community of any road, pedestrian or cycle changes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative traffic impacts</td>
<td>• To manage the potential for cumulative traffic impacts during construction, the Traffic Management Centre (TMC) would coordinate road occupancy licences throughout the corridor.</td>
<td>Traffic Management Centre</td>
<td>Prior to construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td></td>
<td>• Bus services are to be notified in advance of the proposed construction works, including timing.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.4 Noise and vibration

A noise and vibration assessment was developed by Pacific Environment (February 2017) to investigate operational road traffic noise and construction noise and vibration within the study area. The technical paper for this assessment is included in Appendix D of this REF.

6.4.1 Methodology

The methodology of the noise and vibration assessment involved:

- Development of operational noise models with detailed design topographical information
- Identification of sensitive receivers for operational and construction noise
- Background noise monitoring and simultaneous traffic counts to quantify the background environment, develop relevant noise goals and validate the noise model. Noise measurements were carried out between 8th and 16th December 2016 at four locations
- Modelling included the Roads and Maritime provided ADT data based on additional traffic counts undertaken during 2016
- Completing an operational noise assessment based on build and no build scenarios for opening (2015) and design year (2025) scenarios
- Preparation of a construction noise and vibration assessment based on construction methods and staging
- Assessment of road noise impacts from traffic generated during construction.

6.4.2 Existing environment

Noise monitoring locations

The study area consists of urban developments including residential and commercial properties. Sensitive receivers were identified in various noise catchment areas (NCAs). Noise at each NCA was assessed according to geographical location and background monitoring. A child care centre is proposed for the existing car dealership located at the corner of Oak Road and the Princes Highway. Criteria adopted for this assessment considers the child care centre as operational to account for a ‘worst case scenario’.

Table 6-15 presents a summary of the locations where NCAs are located across the study area.
Table 6-15 Noise Monitoring Locations (free field)

<table>
<thead>
<tr>
<th>Monitoring Location</th>
<th>Monitoring Location Address</th>
<th>Distance to Road (m)</th>
<th>Representative Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Bupa Aged Care, Auburn Road Sutherland</td>
<td>12</td>
<td>Representative of receivers in NCAs 1a and 1b, west Acacia Road intersection. Located in field adjacent site approximately 12 m from the carriageway.</td>
</tr>
<tr>
<td>L2</td>
<td>617 Princes Highway Sutherland</td>
<td>13</td>
<td>Representative of receivers in NCAs 2a and 2b, east of Acacia Road intersection. Located on fence line approximately 13 m from the carriageway.</td>
</tr>
<tr>
<td>L3</td>
<td>587 Princes Highway Sutherland</td>
<td>14</td>
<td>Representative of receivers in NCAs 3a and 3b, west of the Oak Road intersection. Located on fence line approximately 14 m from the carriageway.</td>
</tr>
<tr>
<td>L4</td>
<td>848 Kingsway Gymea</td>
<td>8</td>
<td>Representative of receivers in NCA 4, adjacent to the intersection of Princes Highway and Kingsway. Located on fence line, approximately 8 m from the carriageway.</td>
</tr>
</tbody>
</table>

**Measured noise levels**

Four locations (L1 to L4) across the study area were assessed between 8th and 16th December 2016. The measurements were conducted using environmental noise loggers set to measure “fast” A-weighted noise levels. All noise loggers were Type 1 loggers, and carry current calibration certificates. Calibration was checked in-field at the start and end of the monitoring period and no significant drift (± 0.5 dB) was noted.

The Bureau of Meteorology (BoM) Station at Sydney Airport AWS (066037) was used to indicate continuous rainfall data for the assessment. Stations located closer to the study area including Kurnell (066043) and Little Bay (66051) were not representative of inland conditions experienced in the study area. Data points were removed in areas adversely affected by inclement weather and extraneous noise.

**Ambient noise**

More information with regards to assessment and rating background levels as well as monitoring data can be found in Appendix D. Ambient noise is measured as the equivalent continuous noise level ($L_{eq}$) and is described as the noise from all sounds sources.

Over the measurement period (logarithmic average of 15 minute $L_{eq}$), ambient noise represents the equivalent acoustic energy of the fluctuating sound levels from all sources. Assessment periods for ambient noise are listed in Table 6-16.
Background noise levels are represented by the Industrial Noisy Policy’s (INP) rating system, which is a single number known as the rating background level (RBL) given during an assessment period. The RBL is calculated as the median of each Assessment Background Level (ABL) for the period. The ABL for each assessment period is calculated for each day and is the lowest tenth percentile L90 measurement in that assessment period.

Ambient noise levels represent the equivalent acoustic energy of the fluctuating sound levels from all sources over the measurement period. All the sound sources are measured as the equivalent continuous noise level (Leq). The Leq for each assessment period is the logarithmic average of all of the 15 minute Leq noise levels in that period.

Background noise levels are presented Table 6-17. On 15 and 16 December, data was affected by adverse weather and have been excluded. From 9 to 11 December wind speeds greater than 5m/s were identified and did not affect the measured noise levels. These periods were not adversely affected by weather, as analysis excluding these meteorological periods indicated a change in noise level of less than 0.5 dB for most cases.

Table 6-17 Unattended Noise Measurement Results – Ambient Noise Levels

<table>
<thead>
<tr>
<th>Monitoring Location</th>
<th>Address</th>
<th>D</th>
<th>E</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Bupa Aged Care, Auburn Road Sutherland</td>
<td>54</td>
<td>52</td>
<td>41</td>
</tr>
<tr>
<td>L2</td>
<td>617 Princes Highway Sutherland</td>
<td>56</td>
<td>54</td>
<td>41</td>
</tr>
<tr>
<td>L3</td>
<td>587 Princes Highway Sutherland</td>
<td>57</td>
<td>55</td>
<td>42</td>
</tr>
<tr>
<td>L4</td>
<td>848 Kingsway Gymea</td>
<td>58</td>
<td>55</td>
<td>42</td>
</tr>
</tbody>
</table>

Note: Noise levels rounded to a minimum of 30 dB(A).
During the day, road traffic noise from the Princes Highway dominated the ambient noise environment at all locations. The night demonstrated the lowest levels of background noise in comparison to the day and evening.

Traffic noise from the Princes Highway was a constant contributor to background noise levels (L90) at all locations during attended measurements. Location L4 experienced additional traffic influence from the Kingsway.

As a result of constant traffic during the day, noise levels at L1 to L4 were found to be consistent with road traffic. L10 noise levels generally around 3 dB above Leq levels were identified at monitoring locations.

During measurements associated with heavy vehicle presence, peak Lmax events were observed. This was evident during the night time period when traffic noise levels were lower.

**Road noise**

Road traffic noise levels are described in terms of $L_{Aeq,15hr}$ and $L_{Aeq,9hr}$ for the day (7.00am to 10.00pm) and night (10.00pm to 7.00am) periods. Measured traffic noise levels, collected in the free field, are presented in Table 6-18.

**Table 6-18 Measured Road Traffic Noise Levels (free field measurements)**

<table>
<thead>
<tr>
<th>Monitoring Location</th>
<th>Address</th>
<th>Setback (m)</th>
<th>Day $L_{Aeq,15hr}$</th>
<th>N $L_{Aeq,9hr}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Bupa Aged Care, Auburn Road Sutherland</td>
<td>12</td>
<td>64</td>
<td>58</td>
</tr>
<tr>
<td>L2</td>
<td>617 Princes Highway Sutherland</td>
<td>13</td>
<td>65</td>
<td>62</td>
</tr>
<tr>
<td>L3</td>
<td>587 Princes Highway Sutherland</td>
<td>14</td>
<td>67</td>
<td>64</td>
</tr>
<tr>
<td>L4</td>
<td>848 Kingsway Gymea</td>
<td>8</td>
<td>67</td>
<td>63</td>
</tr>
</tbody>
</table>

Notes: 1. Results presented are free field measurements.

At the four monitoring stations (between 8 and 16 December 2016) unattended data was collected concurrently with classified traffic count data. Road traffic noise on adjacent roads contributed the most to noise.

$L_{Aeq}$ noise levels varied between 64 dB and 67 dB at all locations (L1 to L4) during the day period and 58 dB(A) to 64 dB(A) during the night time period. With the exception of L1, all existing noise levels are already close to or above the acute traffic noise level for day and or night periods for all locations.
Traffic volume survey

Traffic counting was conducted at four locations along the proposal for one week (8 to 15 December). Data collected can be found in Appendix D.

6.4.3 Criteria

Construction noise criteria

Construction noise management levels are derived from the *Interim Construction Noise Guidelines* (ICNG). They are targeted at minimising the annoyance from construction noise and measurements are based on background noise readings. The construction noise management levels experienced by residents are reflected in Table 6-19.

Table 6-19 Construction Noise Management Levels at Residences

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Management Level L_{Aeq,15min}</th>
<th>How to Apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended Standard Hours:</td>
<td>Noise affected RBL + 10 dB(A)</td>
<td>The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured L_{Aeq,(15min)} is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.</td>
</tr>
<tr>
<td>Monday to Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.00am to 6.00pm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturday</td>
<td>Highly noise affected 75 dB(A)</td>
<td>The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the</td>
</tr>
<tr>
<td>8.00am to 1.00pm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No work on Sundays or Public Holidays</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences

2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Outside recommended standard hours | Noise affected RBL + 5 dBA

A strong justification would typically be required for works outside the recommended standard hours.
The proponent should apply all feasible and reasonable work practices to meet the noise affected level.
Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

Non-residential receivers may also be impacted by construction noise and a conservative estimate of the difference between internal and external noise levels is 10 dB for this group. Construction noise management levels for buildings other than residences are displayed in Table 6-24.

Table 6-20 Non-residential land use construction noise management levels

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Noise Management Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Premises</td>
<td>$L_{A_{eq},15min} = 70$ dB(A) (external)</td>
</tr>
<tr>
<td>Industrial Premises</td>
<td>$L_{A_{eq},15min} = 75$ dB(A) (external)</td>
</tr>
</tbody>
</table>

The receivers categorised in the non-residential land use group generally fall within NCA 5a and 5b. This group consists of various existing and future commercial activity groups; including car yards and restaurants, a veterinary hospital and a future child care centre.

More stringent child care criterion has been adopted for this location in response to the proposed centre. As majority of these buildings are located within close proximity to the existing Princes Highway, it is assumed that these land uses would be fitted with sufficient building construction materials and windows would remain closed. This would result in an attenuation of approximately 10 dB.
Criteria for construction noise management levels for sensitive land uses are showing in Table 6-21.

Table 6-21 Construction noise management levels for Sensitive Land Uses (External)

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Noise Management Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restaurant / café</td>
<td>LAeq,15min 60 dB(A) (external)</td>
</tr>
<tr>
<td>Retirement homes / villages1</td>
<td>LAeq,15min 50 dB(A) (external)</td>
</tr>
</tbody>
</table>

Note: 1. Adopted for houses and apartments near major roads, as per AS2107.

Project specific construction noise management levels for sensitive receivers are presented in Table 6-22.

Table 6-22 Project Specific (External) Construction Noise Management Levels

<table>
<thead>
<tr>
<th>Location</th>
<th>RBL</th>
<th>Construction Noise Management Level1,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day</td>
<td>Eve</td>
</tr>
<tr>
<td>Receivers – NCA1</td>
<td>54</td>
<td>52</td>
</tr>
<tr>
<td>Receivers – NCA2</td>
<td>56</td>
<td>54</td>
</tr>
<tr>
<td>Receivers – NCA3</td>
<td>57</td>
<td>55</td>
</tr>
<tr>
<td>Receivers – NCA4</td>
<td>58</td>
<td>55</td>
</tr>
<tr>
<td>Commercial Premises</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restaurant / café (5-03)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1. Construction noise criteria calculated as Leq,15min = RBL + 10 dB for day and Leq,15min = RBL + 5 dB for evening and night.
2. Standard hours: Monday to Friday 7.00am to 6.00pm Saturday 8.00am to 1.00pm. OOH day: Saturday 1.00 pm to 6.00 pm Saturday, 7.00 am to 6.00 pm Sunday. OOH evening: Monday to Sunday 6.00pm to 10.00pm. OOH Night time: Monday to Saturday 10.00pm to 7.00am Sunday & Public Holidays 10.00pm to 8.00am.
3. External noise level based on an outside to inside correction of 10 dB(A).

Maximum noise levels from night time construction noise are assessed according to the sleep disturbance screening criteria in the RNP. It is recommended that a sleep disturbance screening criteria of RBL +15 dB(A). The criteria for the residential receivers is therefore 56 dB(A) LAmax for receivers in NCAs 1 and 2, and 57 dB(A) LAmax for receivers in NCAs 3 and 4.
Construction vibration criteria

Impacts from vibration can be considered both in terms of effects on building occupants (human comfort) and the effects on the building structure (building damage). Of these considerations, the human comfort limits are the most stringent. Therefore, for occupied buildings, if compliance with human comfort limits is achieved, it will follow that compliance will be achieved with the building damage objectives.

The EPA administered guideline relevant to human comfort is Assessing Vibration: A Technical Guideline (DEC 2004) provides acceptable values for continuous and impulsive vibration in the range 1-80Hz.

German Standard DIN 4150-3-1999 “Structural Vibration – Part 3 Effects of vibration on structures” provides methods for evaluating the effects of vibration on structures.

The Construction Noise and Vibration Guideline (Roads and Maritime 2016) provides recommended safe working distances for a range of construction activities. The guideline provides for minimum safe working distances to prevent cosmetic damage and human response, and must be complied with at all times, unless additional assessment or monitoring is completed to determine site specific safe working distances.

Operational noise criteria

The Roads and Maritime Noise Criteria Guidelines (NCG) were utilised to assess noise and vibration impacts to sensitive receivers across the proposal area.

The NCG provides four key principles to guide assessment of road noise impacts, being:

- Criteria are based on the road development type affecting a residence due to the road project
- Adjacent and nearby residences should not have significantly different criteria for the same road
- Criteria for the surrounding road network are assessed where a road project generates an increase in traffic noise greater than 2 dB on the surrounding road network
- Existing quiet areas should be protected from excessive changes in amenity due to traffic noise.

It has been determined that the proposal area extends to where noise levels are dominated by other noise sources. Receivers would be assigned new, redeveloped or relative increases in criteria in response to the contribution this proposal has on noise levels.

Criteria by road type

The realignment and upgrade to the existing road would not be considered a redevelopment or new project as defined within the NCG. Thus for the purpose of this assessment, the proposal has been assessed as minor works. Minor works are not considered to be redeveloped or new road types, and therefore the noise level criteria outlined in the NCG are not applicable. A change in the relative noise level from build to no build of less than 2.0 dB is a determining factor in determining whether works can be defined as minor works.
The criteria for existing residences that are affected by additional traffic redevelopment of existing sub-arterial roads is shown in Table 6-23.

Table 6-23 NCG Residential road traffic noise criteria

<table>
<thead>
<tr>
<th>Road Category</th>
<th>Type of Project/Land Use</th>
<th>Assessment Criteria – dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeway/arterial/sub-arterial roads</td>
<td>2. Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads.</td>
<td>LAeq,15hr 60 (external)</td>
</tr>
<tr>
<td></td>
<td>3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments.</td>
<td>LAeq,9hr 55 (external)</td>
</tr>
<tr>
<td>Minor works</td>
<td>Works not intended to increase the traffic carrying capacity or accommodate a notable increase in heavy vehicle traffic</td>
<td>Relative change less than 2.0 dB relative to existing noise levels</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Relative change less than 2.0 dB relative to existing noise levels</td>
</tr>
</tbody>
</table>

**Non-residential criteria**

Specific noise criteria has been developed for non-residential noise-sensitive receivers. Assessment criteria for these noise-sensitive receivers is outlined in Table 6-24.

Noise-sensitive land uses along the proposal corridor include:

- Various commercial activities
- An aged care facility
- Future commercial developments
- A restaurant
- Veterinary hospital
- Future child care centre
Table 6-24 Assessment criteria for non-residential land uses

<table>
<thead>
<tr>
<th>Existing sensitive land use</th>
<th>Assessment Criteria – dB(A)</th>
<th>Additional Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 7am to 10pm</td>
<td>Night 10pm to 7am</td>
</tr>
<tr>
<td>Aged Care Facility</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Child care facilities (future)</td>
<td>Sleeping rooms L_{Aeq}, 1 hr 35 (internal) Indoor play areas L_{Aeq}, 1 hr 40 (internal) Outdoor play areas L_{Aeq}, 1 hr 55 (external)</td>
<td>-</td>
</tr>
</tbody>
</table>

**Maximum Noise Level Assessment**

The Environmental Noise Management Manual (ENMM) was used as to develop a maximum noise level assessment in general accordance with the procedure Preparing an Operational Traffic and Construction Noise and Vibration Assessment Report. Noise levels associated with the potential for sleep levels are determined using the ENMM, however there is no accepted criteria for governing the likelihood of sleep disturbance.

Any single event where the L_{Amax} external noise level exceeds 65 dB(A) and the L_{Amax} noise level exceeds the L_{Aeq, 1hr} noise level by more than 15 dB(A) is classified as a "maximum noise event".

**6.4.4 Potential impacts**

**Construction**

Construction is anticipated to start at the end of 2017 (duration of up to 21 months) and works would occur progressively along the length of the alignment. In the order of seven weeks at a time, works adjacent to individual receivers would occur for periods significantly less than 21 months. Construction hours (as per Roads and Maritime’s Construction Noise and Vibration Guidelines) are presented below in Table 6-25.
Table 6-25 Construction Hours

<table>
<thead>
<tr>
<th>Construction Hours</th>
<th>Monday to Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard hours</td>
<td>7 am to 6 pm</td>
<td>8 am to 1 pm</td>
<td>No work</td>
</tr>
<tr>
<td>Construction activities with impulsive or tonal noise emissions</td>
<td>8 am to 5 pm1</td>
<td>9 am to 1 pm1</td>
<td>No work</td>
</tr>
</tbody>
</table>

Notes: 1. Works may be carried out in continuous blocks not exceeding three hours each with a minimum respite from those activities and works of not less than one hour between each block. ‘Continuous’ includes any period during which there is less than a one hour respite between ceasing and recommencing any of the work the subject of this condition.

To reduce disruptions to daily traffic and surrounding landowners, work outside normal hours may be required. These works would potentially include utility adjustments, asphalting and line marking.

Residential, commercial and sensitive receivers near the proposal would potentially be impacted by construction activities. In particular, receivers located adjacent to the Princes Highway, Acacia Road, Oak Road, Kingsway and adjoining roads would be impacted most.

Construction Activities

Heavy machinery, plant and equipment would operate in a number of locations across the proposal and have the potential to impact nearest residential receivers. Construction scenarios that have the potential to impact receivers are listed in Table 6-26.

Table 6-26 Construction Scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Equipment</th>
<th>Overall Sound Power Level, dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Vegetation Clearing</td>
<td>25t excavator, mulcher, chainsaw, trucks, grader, combination backhoe FEL, elevated work platforms</td>
<td>115</td>
</tr>
<tr>
<td>2 - Earthworks</td>
<td>Road trucks, compactor, grader, steel, multi tyred and vibratory rollers, concrete pour, including trucks and concrete vibrator, asphalt paving plant, skid steer, sweeper, compressors, generators, (excavator with hammer), water trucks</td>
<td>114</td>
</tr>
<tr>
<td>3 - Paving</td>
<td>Road trucks, compactor, (jackhammers), steel, multi tyred and vibratory rollers, concrete pour, including trucks, mixer &amp; concrete vibrator, asphalt paving plant, skid steer, (concrete saw), profiler, sweeper, compressors, generators, light vehicles</td>
<td>110</td>
</tr>
<tr>
<td>4 – Line marking</td>
<td>Line marking truck, compressor, generators, air compressor, concrete truck, light vehicles</td>
<td>110</td>
</tr>
</tbody>
</table>
Construction activities associated with widening works would be in close proximity to a number of sensitive commercial and residential receivers. Due to the construction fleet and the operation of the ancillary site facilities, receivers may be impacted when works are at their closest point. A summary of the construction noise level ranges for each NCA is displayed in Table 6-27.

Table 6-27 Predicted Typical Construction Noise Level Ranges per Scenario per NCA

<table>
<thead>
<tr>
<th>NCA</th>
<th>Noise Management Levels, dB(A)</th>
<th>Noise Level per Scenario, dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard Hours</td>
<td>OOH D</td>
</tr>
<tr>
<td>1a and 1b</td>
<td>64</td>
<td>59</td>
</tr>
<tr>
<td>2a and 2b</td>
<td>66</td>
<td>61</td>
</tr>
<tr>
<td>3a and 3b</td>
<td>67</td>
<td>62</td>
</tr>
<tr>
<td>4</td>
<td>68</td>
<td>63</td>
</tr>
<tr>
<td>5a and 5b</td>
<td>50-70</td>
<td></td>
</tr>
</tbody>
</table>

Standard hours: 7 am to 6 pm Monday to Friday, 8 am to 1 pm Saturday. No works on Sundays or Public Holidays.

Affected sensitive receivers include residential, commercial and restaurants. Construction activities are anticipated to occur within 10 m of the most affected residential receivers, and within 15 m of some commercial receivers. Results indicate that noise levels would exceed NMLs for all construction scenarios in this area. Activities occurring outside standard hours would also result in exceedances of NMLs at the nearest sensitive receivers. The results presented in Table 6-27 are representative of worse case impacts and it is unlikely that plant would operate under these conditions for extended periods.

Works undertaken between 10:00pm and 7:00am would potentially result in sleep disturbance. Impact noise or air break releases would be the primary drivers of maximum noise levels during this period.

Table 6-28 presents the predicted sleep disturbance noise level for each receiver, concluding that noise levels during night time periods have the potential to exceed criteria at the nearest receivers.
Table 6-28 Predicted Sleep Disturbance Noise Level Ranges per Scenario per NCA

<table>
<thead>
<tr>
<th>NCA</th>
<th>Sleep Disturbance Criteria, dB</th>
<th>Maximum Noise Level Range, dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a and 1b</td>
<td>56</td>
<td>36-87</td>
</tr>
<tr>
<td>2a and 2b</td>
<td>56</td>
<td>48-85</td>
</tr>
<tr>
<td>3a and 3b</td>
<td>57</td>
<td>46-88</td>
</tr>
<tr>
<td>4</td>
<td>57</td>
<td>41-77</td>
</tr>
</tbody>
</table>

Note: 1. Sleep disturbance criteria apply to residential land uses only.

Investigations have determined that typical earthmoving equipment to shape stockpiles, and full operation of equipment during these activities at compound sites, would potentially impact the nearest receivers. For receivers within approximately 75 metres of the sites, noise levels are predicted to exceed noise management levels during operations. These values are based on simultaneous operations of all equipment, and are considered highly conservative.

Construction traffic on project roads has been calculated to be less than 0.5 dB for daytime and 1.5 dB for night time periods, resulting in marginal impacts at the nearest receivers, due to the numbers of vehicles already using the affected roads.

The construction activities have the potential to affect a number of residential, commercial and sensitive receivers near the proposal. The most potentially affected receivers are located adjacent to the Princes Highway, Acacia Road, Oak Road, Kingsway and adjoining roads. Details of sensitive receivers are presented in the noise catchment areas shown in Figure 6-17. The construction impact receivers are consistent with the receivers for the operational noise assessment.

**Construction vibration**

Where activities using significant sources of vibration occur within close proximity to structures and identified receivers, potential impacts are likely to be increased. Construction works for the proposal would involve the use of vibratory rollers and excavators with a hammer attachment. In consideration of safe working distances provided in the Construction Noise and Vibration Guideline (Roads and Maritime 2016), no buildings facing the proposal are within the safe working distance for jackhammers. This may impact on residential residences located within NCAs 1a and 1b, 2a and 2b, 3a and 3b, 4.

It is recommended that vibration testing be completed where vibratory rollers and hammers are proposed to be used within 20 metres of residences, depending on the rating of equipment to be used. Potential vibration impacts would be managed through the implementation of construction vibration mitigation measures detailed as part of the construction noise and vibration management plan.

**Operational**

Noise catchment areas (NCAs) have been identified within the study area and displayed in Table 6-29.
### Table 6-29 Noise Catchment Areas and Monitoring Locations

<table>
<thead>
<tr>
<th>Monitoring Location / NCA</th>
<th>Monitoring Location Address</th>
<th>NCA</th>
<th>Representative Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Bupa Aged Care, Auburn Road Sutherland</td>
<td>NCA1a</td>
<td>Receivers north of the Princes Highway between Auburn Street and 80 m east of Acacia Road</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NCA1b</td>
<td>Receivers south of the Princes Highway between Auburn Street and 80 m east of Acacia Road</td>
</tr>
<tr>
<td>L2</td>
<td>617 Princes Highway Sutherland</td>
<td>NCA2a</td>
<td>Receivers north of the Princes Highway between 80 m east of Acacia Road and 50 m east of Kenneth Avenue</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NCA2b</td>
<td>Receivers south of the Princes Highway between 80 m east of Acacia Road and 50 m east of Kenneth Avenue</td>
</tr>
<tr>
<td>L3</td>
<td>587 Princes Highway Sutherland</td>
<td>NCA3a</td>
<td>Receivers north of the Princes Highway between 50 m east of Kennet Avenue and Oak Road</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NCA3b</td>
<td>Receivers south of the Princes Highway between 50 m east of Kennet Avenue and Oak Road</td>
</tr>
<tr>
<td>L4</td>
<td>848 Kingsway Gymea</td>
<td>NCA4</td>
<td>NCA4, including receivers on the Princes Highway and Kingsway Bath Road and Hotham Road</td>
</tr>
<tr>
<td>n/a</td>
<td>n/a</td>
<td>NCA5a</td>
<td>Commercial receivers north of the Princes Highway between Oak Road and Bath Road</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NCA5b</td>
<td>Commercial receivers south of the Princes Highway between Oak Road and Bath Road</td>
</tr>
</tbody>
</table>

Predicted traffic volume data at four locations was collected and analysed using modelled traffic scenarios (refer to Table 6-30). Average daily traffic volumes were provided by the project traffic consultants and utilised in coordination with the measured traffic count data. The modelled traffic volumes are summarised in Table 6-31. Noise modelling inputs and other relevant information is described in Appendix D.
Table 6-30 Modelled Traffic Scenarios

<table>
<thead>
<tr>
<th>Year</th>
<th>Description and Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020 No Build</td>
<td>Volumes provided for opening year assuming no build traffic volumes, without the upgrade. This represents the project opening year.</td>
</tr>
<tr>
<td>2020 Build</td>
<td>Volumes provided for opening year assuming project development. This represents the project opening year, and traffic volumes assuming upgrade is complete.</td>
</tr>
<tr>
<td>2030 No Build</td>
<td>This represents the design year (10 years after opening) without the upgrade. No Build scenario volumes include traffic growth and existing road configurations.</td>
</tr>
<tr>
<td>2030 Build</td>
<td>This represents the design year (10 years after opening), upon completion of the upgrade. Volumes for design year assume proposal layout and 2030 NB traffic volumes.</td>
</tr>
</tbody>
</table>

Table 6-31 Modelled Traffic Volumes

<table>
<thead>
<tr>
<th>Project Road</th>
<th>PerIOD</th>
<th>2020 No Build</th>
<th>2020 Build</th>
<th>2030 No Build</th>
<th>2030 Build</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old Princes Highway (west of Acacia Road)</td>
<td>Day</td>
<td>40695</td>
<td>40695</td>
<td>41601</td>
<td>41601</td>
</tr>
<tr>
<td></td>
<td>Night</td>
<td>6014</td>
<td>6014</td>
<td>6148</td>
<td>6148</td>
</tr>
<tr>
<td>Princes Highway (east of Acacia Road)</td>
<td>Day</td>
<td>57424</td>
<td>57424</td>
<td>67216</td>
<td>67216</td>
</tr>
<tr>
<td></td>
<td>Night</td>
<td>10782</td>
<td>10782</td>
<td>12638</td>
<td>12638</td>
</tr>
<tr>
<td>Oak Road</td>
<td>Day</td>
<td>7560</td>
<td>7560</td>
<td>7582</td>
<td>7582</td>
</tr>
<tr>
<td></td>
<td>Night</td>
<td>961</td>
<td>961</td>
<td>964</td>
<td>964</td>
</tr>
<tr>
<td>Kingsway</td>
<td>Day</td>
<td>25344</td>
<td>25344</td>
<td>27575</td>
<td>27575</td>
</tr>
<tr>
<td></td>
<td>Night</td>
<td>2787</td>
<td>2787</td>
<td>3033</td>
<td>3033</td>
</tr>
</tbody>
</table>

Note: 1. Day night splits based on traffic count data.
Predicted noise levels

Traffic on the local road network near the proposal is limited and noise monitoring data indicated that existing noise levels are controlled by traffic flows on the Princes Highway. The minor changes to the road alignment would not noticeably affect noise levels and noise receivers at in this area of the proposal would continue to experience controlled noise from flows on the Princes Highway.

Predicted noise levels have been developed in response to the proposal. Predictive modelling indicates that the change in noise level as a result of the project is generally less than 2.0 dB over the project area for all receivers in all NCAs, indicating that the works would not exceed the minor works criteria in this area.

The majority of receivers in NCAs 1 to 4 are residential receivers and would be affected by noise. In particular, the reconfiguration of the road and addition of lanes at intersections would see receivers closer to the road. However noise modelling predictions have indicated that as a result of the proposal, changes in noise levels within 2 dB would occur. A summary of the results of the investigation are represented in Table 6-32.

Table 6-32 Summary of Predicted Noise Results, Predicted Noise Levels per NCA and the relative increase for build and no build scenarios.

<table>
<thead>
<tr>
<th>NCA</th>
<th>Predicted Noise Level (2030) with no proposal</th>
<th>Predicted Noise Level (2030) with the proposal builds</th>
<th>Relative Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day</td>
<td>Night</td>
<td>Day</td>
</tr>
<tr>
<td>1a and 1b</td>
<td>74</td>
<td>69</td>
<td>75</td>
</tr>
<tr>
<td>2a and 2b</td>
<td>75</td>
<td>70</td>
<td>75</td>
</tr>
<tr>
<td>3a and 3b</td>
<td>75</td>
<td>70</td>
<td>75</td>
</tr>
<tr>
<td>4</td>
<td>74</td>
<td>68</td>
<td>73</td>
</tr>
</tbody>
</table>

Note: the 1B reductions reflected in noise levels (between the build and no build results) from the acoustic model are considered to be the same noise level for the purpose of this assessment.
No receivers would experience noise increases above 2dB as a result of the proposal. As shown in Table 6-32, predicted noise level as a result of the proposal at each noise catchment area would include:

- **Residential receivers (including the Bupa Aged Care facility) in NCA 1a and 1b were generally found to experience noise levels following the upgrade within 2 dB of existing noise levels**
- **For receivers in NCA 2a and 2b, the results in Appendix E of Appendix D indicate that generally receivers were found to experience noise levels following the upgrade within 2dB of existing noise levels, with maximum increases of up to 1.3 dB**
- **For receivers in NCA 3a and 3b, the results indicate that generally receivers were found to noise levels following the upgrade within 2dB of existing noise levels, with maximum increases of up to 1.5 dB**
- **Receivers in NCA 4 results indicate that generally receivers were found to experience noise levels following the upgrade within 2dB of existing noise levels with maximum increases of up to 1.0 dB, indicating that the works are minor works in this area. The results at the future child care centre (located in NCA5) indicate that noise levels increase by up to 0.4 dB as a result of the project. Existing noise levels are predicted at 67 dB, which exceeds the outdoor play area criteria, however the existing levels of road traffic noise would need to be accounted in the design and layout of any future development**
- **At the proposed child care centre a 10 dB correction has been applied for to account for possible external to internal transmission loss with windows partially open. The results at the future child care centre would exceed outdoor criteria however the existing levels of traffic noise would need to be accounted for in design of the development.**

**Maximum noise levels**

During 5:00am and 6:00am, the average emergence is greatest for the study area at L1 of up to 23 dB (A). The average emergence across all locations is around 18 dB above the Leq,1hr levels.

Maximum noise impacts are already experienced across the study area, as there are more than two to three events greater than Leq,1hr +15 dB per night with an average emergence of 18 dB(A). Of these emergent events there are more than 2-3 events per night that exceed 65 dB(A) at all locations.

Depending on the alignment’s changes relative to receivers, maximum noise level impacts would change. There is potential for the Lmax noise level to increase where the alignment is moving closer to residences, such as L1 and L2. NCAs 3 and 4 are not expected to change significantly (<0.5 dB) as a result of the change in alignment.
### 6.4.5 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise and vibration impacts to sensitive receivers day and night works</td>
<td>Works to be carried out during normal work hours (i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays). Any work that is performed outside normal work hours or on Sundays or public holidays is to minimise noise impacts.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard N1</td>
</tr>
<tr>
<td>Noise and vibration impacts to sensitive receivers</td>
<td>Noise impacts are to be minimised in accordance with the Roads and Maritime Services Construction Noise and Vibration Guidelines 2016</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard N2</td>
</tr>
<tr>
<td>Vibration impacts to properties adjacent to the construction works</td>
<td>Measures, including allowing adequate distance that rollers can come to adjacent buildings and/or using non vibrating rollers, are to be used to minimise or prevent vibration impacts</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard N3</td>
</tr>
</tbody>
</table>
| Noise and vibration at site compound                                   | • Consider construction compound layout so that primary noise sources are at a maximum distance from sensitive receivers (primarily residential receivers), with solid structures (sheds and containers) placed between sensitive receivers and noise sources (and as close to the noise sources as is practical).  
  • Locate compressors, generators, pumps and any other fixed plant as far from residences as possible and behind site structures  
  • Vehicle delivery times will be scheduled where feasible to the recommended construction | Contractor     | Construction| Additional safeguard          |
<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
</table>
| Noise management and mitigation – Source controls (3-10 dB reduction) | Source control reductions (3-10 dB reduction) will be considered through implementation of the following:  
* Using noise source controls, such as the use of residential class mufflers, to reduce noise from all plant and equipment including skid steers, cranes, graders, excavators and trucks.  
* Limiting the number of plant and equipment on site.  
* Avoiding using noisy plant simultaneously and/or close together, adjacent to sensitive receivers.  
* Using lower powered or reduced size equipment where noise benefits are available, where practical.  
* Design compound / ancillary / stockpile facilities such that vehicle access in a forward direction is preferred, to minimise use of reversing alarms, where feasible and reasonable.  
* Using spotters and broadband reversing alarms in place of traditional beeper reversing alarms, where practical and feasible.  
* Operating machinery in a manner which reduces maximum noise level events including excavators and dozers.  
* Ensuring plant and equipment is well maintained and not generating excessive noise. | Contractor | Construction | Additional safeguard |
<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
</table>
| Noise management and mitigation – Path controls (3-10 dB reduction) | • Avoiding the use of horns and alarms, especially at night.  
• Turning off machinery when not in use.  
• Avoid dropping materials and tools or dragging materials across hard surfaces.  
• Path controls (3-10 dB reduction) reductions will be considered through implementation of the following:  
  • Maximising the offset distance between noisy plant items and sensitive receivers.  
  • Allow adequate distance that rollers can come to adjacent buildings and/or using non vibrating rollers.  
  • Orienting equipment away from sensitive receivers.  
  • Using items to screen mobile plant and equipment.  
  • Arrange site accesses to minimise impacts on sensitive receivers.  
  • Carrying out loading and unloading away from sensitive receivers.  
  • Selecting site access points and roads as far as possible away from sensitive receivers. | Contractor | Construction | Additional safeguard |
<p>| Additional noise mitigation measures (refer to Section 6.4.6) | Where exceedances are still expected to occur after standard mitigation measures (refer to 6.4.5) have been applied, the Construction Noise and Vibration Guideline (Roads and Maritime 2016) recommends the implementation of additional | Contractor | Construction | Additional safeguard |</p>
<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction vibration impacts to human comfort and buildings</td>
<td></td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>• Preparation and implementation of a Construction Noise and Vibration Management Plan (CNVMP) for the proposal to identify detailed assessment methods for high risk works, identify receivers, complaints handling and consultation protocols.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Increase separation distance between vibration source and sensitive receiver where feasible and reasonable.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Substitution of methods of high vibration emission to lower vibration methods.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Vibration monitoring as required, to validate predictions and as part of vibration impact management including:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Undertaking trial measurements to establish the site specific vibration propagation from high risk activities to establish site specific offset distances required for compliance with the cosmetic building damage criteria.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Alternatives to high vibration source plant and equipment should be used where reasonable and feasible.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Specific definitions for the terms used are presented in the guideline.
### Impact
- Vibration monitoring as required, as part of vibration impact management.
- Where vibration monitoring is undertaken and criteria exceedances are identified, management measures should be implemented immediately to ensure vibration compliance is achieved.

### 6.4.6 Additional noise mitigation measures

Where exceedances are still expected to occur after standard mitigation measures (refer to 6.4.5) have been applied, the Construction Noise and Vibration Guideline (Roads and Maritime 2016) recommends the implementation of additional mitigation measures. These mitigation measures are presented in Table 6-33. Specific definitions for the terms used are presented in the guideline.

**Table 6-33 Triggers for Additional Mitigation Measures – Airborne Noise**

<table>
<thead>
<tr>
<th>Perception</th>
<th>dB(A) above RBL</th>
<th>dB(A) above NML</th>
<th>Additional Mitigation Measures Type 1</th>
<th>Mitigation Levels 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Hours</td>
<td></td>
<td></td>
<td>N, V, PC, RO</td>
<td>HA</td>
</tr>
<tr>
<td>75dBA or greater</td>
<td></td>
<td></td>
<td>N, V, PC, RO</td>
<td>HA</td>
</tr>
<tr>
<td>Noticeable</td>
<td>5 to 10</td>
<td>0</td>
<td>-</td>
<td>NML</td>
</tr>
<tr>
<td>Clearly Audible</td>
<td>10 to 20</td>
<td>&lt;10</td>
<td>-</td>
<td>NML</td>
</tr>
<tr>
<td>Moderate Intrusive</td>
<td>20 to 30</td>
<td>20 to 30</td>
<td>N/V</td>
<td>NML+10</td>
</tr>
<tr>
<td>Intrusiveness</td>
<td>&gt;=30</td>
<td>&gt;=20</td>
<td>N/V</td>
<td>NML+20</td>
</tr>
<tr>
<td>------------------------</td>
<td>------</td>
<td>------</td>
<td>-----</td>
<td>--------</td>
</tr>
</tbody>
</table>

**OOHW Period 1:** Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)

<table>
<thead>
<tr>
<th>Intrusiveness</th>
<th>&gt;=30</th>
<th>&gt;=20</th>
<th>N/V</th>
<th>NML+20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noticeable</td>
<td>5</td>
<td>5</td>
<td>-</td>
<td>NML</td>
</tr>
<tr>
<td>Clearly Audible</td>
<td>10</td>
<td>5</td>
<td>N, R1, DR</td>
<td>NML+5</td>
</tr>
<tr>
<td>Moderate Intrusive</td>
<td>20</td>
<td>15</td>
<td>V, N, R1, DR</td>
<td>NML+15</td>
</tr>
<tr>
<td>Highly Intrusive</td>
<td>&gt;30</td>
<td>&gt;25</td>
<td>V, IB, N, R1, DR, PC, SN</td>
<td>NML+25</td>
</tr>
</tbody>
</table>

**OOHW Period 2:** Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)

<table>
<thead>
<tr>
<th>Intrusiveness</th>
<th>&gt;=30</th>
<th>&gt;=20</th>
<th>N/V</th>
<th>NML+20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noticeable</td>
<td>5</td>
<td>5</td>
<td>N</td>
<td>NML</td>
</tr>
<tr>
<td>Clearly Audible</td>
<td>10</td>
<td>5</td>
<td>V, N, R2, DR</td>
<td>NML+5</td>
</tr>
<tr>
<td>Moderate Intrusive</td>
<td>20</td>
<td>15</td>
<td>V, IB, N, PC, SN, R2, DR</td>
<td>NML+15</td>
</tr>
<tr>
<td>Highly Intrusive</td>
<td>&gt;30</td>
<td>&gt;25</td>
<td>V, IB, N, PC, SN, R2, DR</td>
<td>NML+25</td>
</tr>
</tbody>
</table>

**Notes:**
1. R1 = Respite Period 1
2. V = Verification
3. PC = Phone calls
4. IB = Individual briefings
5. SN = Specific notifications
6. N = Notification
7. R2 = Respite Period 2
8. DR = Duration Respite
9. Perception = relates to level above RBL

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2. NML = Noise Management Level (see Appendix D)

HA = Highly Affected (> 75 dB(A) - applies to residences only)


The guideline states that these mitigation measures are more applicable to short term construction activities, as these measures may become less effective with increasing durations of works. It is considered that due to the transient nature of these linear construction activities, the above mitigation measures would still be appropriate and effective.

6.5 Non-aboriginal heritage

Artefact Heritage was engaged to prepare a SOHI for the proposal. A copy of the SOHI is provided in Appendix E and a summary of the findings are presented below.

6.5.1 Methodology

Determining the significance of archaeological items or items of heritage significance is carried out using the system of assessment informed by the *Burra Charter of Australia’s 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 significance is outlined through legislation in the Heritage Guidelines (NSW Heritage Office 1196:25-27).

If an item meets one of the seven heritage criteria, and retains the integrity of its key attributes, it can be considered to have significance. The significance of an item or potential archaeological site can be assessed as being of state or local significance, based on a series of criteria that have been developed for assessing significance relating to archaeological sites and their associated relics. The criteria identify a series of questions that could be asked in relation to the item to assist in the identification of the appropriate level of significance to be applied. Heritage significance assessment criteria are outlined in Table 6-34.
Table 6-34 NSW heritage assessment of significance criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A – Historical significance</td>
<td>An item is important in the course or pattern of the local area’s cultural or natural history</td>
</tr>
<tr>
<td>B – Associative significance</td>
<td>An item has strong or special associations with the life or works of a person, or group of persons, of importance in the local area’s cultural or natural history</td>
</tr>
<tr>
<td>C – Aesthetic or technical significance</td>
<td>An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in the local area</td>
</tr>
<tr>
<td>D – Social significance</td>
<td>An item has strong or special association with a particular community or cultural group in the local area for social, cultural or spiritual reasons</td>
</tr>
<tr>
<td>E – Research potential</td>
<td>An item has potential to yield information that will contribute to an understanding of the local area’s cultural or natural history</td>
</tr>
<tr>
<td>F – Rarity</td>
<td>An item possesses uncommon, rare or endangered aspects of the local area’s cultural or natural history</td>
</tr>
<tr>
<td>G – Representative</td>
<td>An item is important in demonstrating the principal characteristic of a class of the State’s (or local area’s): Cultural or natural places Cultural or natural environments.</td>
</tr>
</tbody>
</table>

Heritage Street Trees Field Survey

A site inspection was conducted on 15 February 2017 to identify and assess the nature of the heritage street trees and the impact of the proposal. A physical analysis of the study area was conducted, including database searches, site inspections and review of relevant state legislation (ISEPP 2007).

6.5.2 Existing environment

Existing heritage items were identified through desktop searches of relevant state and local government heritage registers, along with a site survey. Local heritage items are described below.

A search of the following databases and sources was undertaken in January 2017:

- National Heritage List
- Commonwealth Heritage List
- State Heritage Register
- Sydney Trains and Roads and Maritime Section 170 Registers
Sutherland Shire LEP Schedule 5 (heritage) and maps.

There are no non-Aboriginal heritage items listed on the National Heritage List, the Commonwealth Heritage List, the State Heritage Register and the Sydney Trains and Roads and Maritime Section 170 Registers within the proposal or in close proximity to the proposal.

Two local heritage items which are listed on Schedule 5 ‘Environmental Heritage’ of the Sutherland Shire LEP are located in the proposal (refer to Figure 6-18 and Table 6-35). These items are located on the northern side of the Old Princes Highway, between Acacia Road North and Auburn Street, Sutherland, and the intersection of the Princes Highway and The Kingsway, Gymea.

These items are located on the northern side of the Old Princes Highway, between Acacia Road North and Auburn Street, Sutherland, and the intersection of the Princes Highway and The Kingsway, Gymea.

Table 6-35 Heritage Items – Heritage registers search results

<table>
<thead>
<tr>
<th>Listing</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSLEP 2015 (Item No. I3601)</td>
<td>Tree cluster, consisting of <em>Eucalyptus microcorys</em> (Tallow Wood), <em>Eucalyptus pilularis</em> (Blackbut) and <em>Eucalyptus saligna</em> (Sydney Blue Gum)</td>
<td>Along southern edge of 101 Acacia Road and within the adjacent road reservation on northern side of Old Princes Highway, Sutherland</td>
</tr>
<tr>
<td>SSLEP 2015 (Item No. I1509)</td>
<td>Stands of <em>Eucalyptus microcorys</em> (Tallow Wood), <em>Eucalyptus pilularis</em> (Blackbut), <em>Eucalyptus racemosa</em> (Snappy Gum or Small-leaf Scribbly Gum), <em>Eucalyptus grandis</em> (Rose Gum) and <em>Eucalyptus globoidea</em> (White Stringybark)</td>
<td>Along Princes Highway (between Kingsway and The Boulevarde), Gymea</td>
</tr>
</tbody>
</table>

**Development of the Princes Highway**

The Princes Highway was previously a collection of roads, before being named the ‘Princes Highway’. Tree planting programmes were organised by Sutherland Council during the 1930s as part of the relief schemes for the unemployed. Tree planting occurred along Lilli Pilli Point Road, and sections of The Kingsway and Princes Highway in Kirrawee. Aerial photography from 1943 (refer to Figure 6-19 and Figure 6-20) and the nature of the plantings determined from the site inspection indicate that both heritage items may consist of some possible remnant forest vegetation, as well as twentieth and twenty-first century native plantings.
Figure 6-19 1943 aerial photograph showing the avenue of trees planted along the Old Princes Highway. Heritage Item I3601 highlighted in yellow

Figure 6-20 1943 aerial photograph showing possible remnant forest vegetation within the pertinent section of Heritage Item I1509
Heritage Item I3601

Located on each side of the path along the northern side of the Old Pacific Highway between Acacia Road North and Auburn Street, the trees appear to be a mix of remnant forest vegetation within 101 Acacia Road, as well as twentieth and twenty-first century plantings along the reserve. Mature trees as well as adolescent and recent plantings surrounded by mesh cages are spread along the grassed kerb. The trees within the listing are located on each side of a path along the grassed kerb, as well as with the southern boundary of the adjacent property at 101 Acacia Road. Figure 6-21 and Figure 6-22 show the trees along the path which form a constructed avenue.

Figure 6-21 Heritage item I3601, from Acacia Road (eastern boundary)
Figure 6-22 Heritage item I3601, from Auburn Street (western boundary)

**Heritage Item I1509**

On the eastern side of the junction of the Princes Highway and Kingsway, the trees in this area form a reserve. A mix of remnant, twentieth and twenty-first century plantings are found in this area and are shown in Figure 6-23 and Figure 6-24. Mature trees as well as adolescent and recent plantings surrounded by mesh cages are planted in lines along the Princes Highway, with some mature trees out of alignment.
Figure 6-23 Heritage item I1509, from the junction, looking east

Figure 6-24 Heritage item I1509, looking north-east along the Princes Highway.
Assessment of significance

An assessment of significance for both heritage items (I3601 and I1509) are considered to be items of local significance. Table 6-36 and Table 6-37 below present an assessment of these items against NSW heritage assessment criteria provided in section 6.5.1 above. Both heritage items have historic and aesthetic significance at the local level for native trees. The item is therefore representative of remnant forest vegetation, as well as plantings undertaken by Council over the history of the occupation of the area. These trees are representative of the many trees along the Princes Highway and Old Princes Highway that have survived since the 1930’s depression, despite continuous urbanisation.

Table 6-36 Significance assessment for Heritage Item I3601

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A – Historical significance</td>
<td>The trees within Heritage Item I3601 have been planted over a variety of periods, including the early twentieth century and twenty-first century. The heritage item also appears to include some remnant vegetation. Two of the trees (the two Eucalypts at the south-western corner of the item) may have been planted during the 1930s-depression relief scheme instigated by Sutherland Council. The item meets the threshold of local significance under this criterion.</td>
</tr>
<tr>
<td>B – Associative significance</td>
<td>Though it is likely that the two Eucalypt trees at the south-western corner of the subject site were planted during the 1930s as part of Sutherland Council’s depression relief scheme, this has not been substantiated. Therefore, the item cannot be considered to have a strong or special association with the life or works of a person, or group of persons, of importance in the cultural or natural history of the local area. The item does not meet the threshold of local significance under this criterion.</td>
</tr>
<tr>
<td>C – Aesthetic or technical significance</td>
<td>Mature Eucalypt plantings and adolescent trees along the southern side of the pedestrian path through the item, combined with possible remnant Blackbutt and Smooth-barked Apple trees, create an aesthetically significant “avenue” effect. The views along the “avenue” of trees and from Princes Highway are of aesthetic significance. The item meets the threshold of local significance under this criterion.</td>
</tr>
<tr>
<td>D – Social significance</td>
<td>Though it is likely that the two Eucalypt trees at the south-western corner of the subject site were planted by the unemployed during the 1930s as part of Sutherland Council’s depression relief scheme, this has not been substantiated. Therefore, though the item may have a special association with the Council or the unemployed workers, the item cannot be considered to have a definitive association with a particular community or cultural group of importance in the cultural or natural history of the local area. The item does not meet the threshold of local significance under this criterion.</td>
</tr>
</tbody>
</table>
There is nil-low potential for archaeological remains associated with the occupation of this area due to the nature of the heritage item being street trees, other than small isolated finds that were accidentally dropped during planting. The item does not meet the threshold for **local significance** under this criterion.

There are many similar remnant trees along the Princes Highway and the Old Princes Highway and trees associated with the 1930s depression-relief plantings. The heritage item, however, does contribute to the overall rarity of the remnant plantings along the Princes Highway. The item **does not** meet the threshold of local significance under this criterion.

The item is potentially representative of remnant native trees that survived the extensive clearing of the area, but certainly represents the native tree species of the area. The item also possibly represents the 1930s depression relief scheme plantings and certainly represents later twentieth century plantings. The item is therefore representative of native vegetation and plantings undertaken by Council over the history of the occupation of the area despite and as a response to ongoing urbanisation. It is representative of the many trees along the Princes Highway and Old Princes Highway. The item meets the threshold of **local significance** under this criterion.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A – Historical significance</td>
<td>The trees within Heritage Item I1509 comprise some remnant vegetation as well as plantings from a variety of periods, including the early twentieth century and twenty-first century. The item meets the threshold of <strong>local significance</strong> under this criterion.</td>
</tr>
<tr>
<td>B – Associative significance</td>
<td>The item cannot be considered to have a strong or special association with the life or works of a person, or group of persons, of importance in the cultural or natural history of the local area. The item <strong>does not</strong> meet the threshold of local significance under this criterion.</td>
</tr>
<tr>
<td>C – Aesthetic or technical significance</td>
<td>Mature Eucalypt plantings and adolescent trees, combined with possible remnant Blackbutt and Smooth-barked Apple trees, create an aesthetically significant representation of remnant and planted trees. The remnant native trees demonstrate the quintessential “Australian character” and provide evidence for prehistoric ecology. The views of the group of trees from the Kingsway and Princes Highway are of aesthetic significance. The item meets the threshold of <strong>local significance</strong> under this criterion.</td>
</tr>
</tbody>
</table>
D – Social significance

Though remnant native trees can have social significance due to the connection between the Aboriginal people and the forest as well as the use of such timber by European settlers, there is no known definitive social significance of the trees within the heritage item. Therefore, though the item may have a special association with these people groups, the item cannot be considered to have a certain association with a particular community or cultural group of importance in the cultural or natural history of the local area.

The item does not meet the threshold of local significance under this criterion.

E – Research potential

There is nil-low potential for archaeological remains associated with the occupation of this area due to the nature of the heritage item, other than small isolated finds that were accidentally dropped during planting or timber-getting.

The item does not meet the threshold for local significance under this criterion.

F – Rarity

There are many similar remnant trees along the Princes Highway and the Old Princes Highway and trees associated with the 1930s depression-relief plantings. The heritage item, however, does contribute to the overall rarity of the remnant plantings along the Princes Highway.

The item does not meet the threshold of local significance under this criterion.

G – Representative

The item represents a range of possible remnant trees, as well as Twentieth Century plantings, of which there are a number along the Princes Highway and Old Princes Highway. The item is therefore representative of native vegetation and plantings undertaken by Council over the history of the occupation of the area despite and as a response to ongoing urbanisation. It is representative of the many trees along the Princes Highway and Old Princes Highway.

The item meets the threshold of local significance under this criterion.

6.5.3 Potential impacts

Construction

The proposal would involve the removal of about six mature trees comprising those species listed in Figure 6-19 and Figure 6-20, from the cluster of trees that forms heritage item 3601. Two trees would be removed from heritage item 1509 and have been identified as *Eucalyptus pilularis* (Blackbutt).

An investigation by Artefact Heritage was conducted on 15 February 2017 to identify sections along the Old Princes Highway that require tree removal. The following items have been identified within the local heritage items I3601 and I1509 under the SSLEP 2015.
**Heritage Item I3601**
- Two pre-1943 trees, possibly planted as part of the 1930s-depression relief scheme (Figure 6-25 and Figure 6-26)
- Two mature post-1943 trees (Figure 6-28 and Figure 6-28)
- Two adolescent post-1943 trees (refer to Appendix E) and
- About twenty recently planted trees (refer to Appendix E).

**Heritage Item I1509**
- Two mature pre-1943 trees (Figure 6-29 and Figure 6-30).

Figure 6-25 Pre-1943 Tree 1 to be removed within heritage item I3601
Figure 6-26 Pre-1943 Tree 2 to be removed within heritage item I3601

Figure 6-27 Mature Post-1943 Tree 1 to be removed within heritage item I3601
Figure 6-28 Mature Post-1943 Tree 2 to be removed within heritage item I3601

Figure 6-29 Tree 1 to be removed within heritage item I1509
Figure 6-30 Tree 2 to be removed within heritage item I1509

The removal of pre-1943 mature trees within heritage item I3601 would impact the social, historical and aesthetic heritage values of the item. These trees are likely to date back to the 1930s depression relief schemes of the Sutherland Shire Council. The removal of the post-1943 mature and adolescent trees would reduce the item’s aesthetic significance. Little heritage significance is contributed by the recent plantings within the item, and their removal would have a minor impact. It has been identified that the removal of this southern avenue of trees within heritage item I3601 would have a moderate to major impact on heritage significance. Some trees dating prior to 1943 comprise part of the 50 trees which would be left within the heritage item.

The two pre-1943 mature trees within heritage item I1509 to be removed contribute to the aesthetic significance of the north-western boundary of the heritage item. These trees would have been planted in the 1930s depression relief scheme or as remnant forest trees and their removal would have a minor impact on the heritage item. Over 20 mature trees and over thirty recent plantings would be left within the section of the heritage item.

Impact to heritage items I3601 and I1509 would be moderate to major and minor, respectively. Both items would retain significance at the local level, therefore delisting from the LEP would not result from the proposed works. To alleviate congestion issues and reduce journey time on the Princes Highway and Old Princes Highway, the removal of these trees would be required. Over time, the impact of the removal of these trees would be reversible, due to the opportunity for regrowth and the planting of new trees.
**Sydney Water installation**

The Sydney Water main adjustment would take place at a grassed area at the north end of the car park located on the Old Princes Highway. The installation would be confined to an area within the grassed section and would not impede any surrounding heritage items. There are three heritage items that are in close proximity to the installation works including:

- Heritage item 3635 – Commercial building, directly west of the installation site at 685 Old Princes Highway, Sutherland
- Heritage item 3602 - parallel with the Old Princes Highway from 685 to 691 Old Princes Highway, Sutherland
- Heritage item 3616 - Forby Sutherland Memorial Park to the south west of the installation works, Lot 1 Old Princes Highway, Sutherland.

All three heritage items would not be impacted by the Sydney Water main adjustment.

**Operation**

No operational impacts would be expected on items of Non-Aboriginal heritage.

### 6.5.4 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Aboriginal heritage</td>
<td>A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage.</td>
<td>Contractor</td>
<td>Detailed design / pre-construction</td>
<td>Core standard safeguard H1&lt;br&gt;Section 4.10 of QA G36 Environment Protection</td>
</tr>
<tr>
<td>Non-Aboriginal heritage</td>
<td>- The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered.&lt;br&gt;- Work will only recommence once the requirements of that procedure have been satisfied.</td>
<td>Contractor</td>
<td>Detailed design / pre-construction</td>
<td>Core standard safeguard H2&lt;br&gt;Section 4.10 of QA G36 Environment Protection</td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
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<td>---------------</td>
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</tr>
</tbody>
</table>
| Heritage trees | • During roadworks and where removal of trees is unavoidable, the remaining trees are to be protected from potential harm by advice from a suitably qualified arborist.  
• The arborist is to provide management guidelines for the protection of roots, trunks and branches. | Arborist       | Construction | Additional safeguard             |
| Heritage trees | • Where trees are slated for relocation or total removal, a Photographic Archival Recording (PAR) should be prepared prior to all works.  
• The report must consist of an archival standard photographic record of the site, noting the location and details of the trees to be removed as well as demonstrating the overall setting within the streetscape. | Roads and Maritime | Pre-construction | Additional safeguard             |
6.6 Landscape character and visual impacts

Potential impacts on landscape character and visual impacts have been assessed in the Landscape character and visual impacts technical paper (Appendix F). A summary of the outcomes is provided here.

6.6.1 Methodology

Assessment criteria based on landscape character zones (LCZ) has been developed in response to the uses and function of the upgraded road. Visual impacts have been assessed by identifying six viewpoints and determining the overall impact of key features of the proposal.

The Roads and Maritime impact grading matrix has been utilised to quantify landscape character and visual impacts (refer to Table 6-38). Two factors were used to determine the overall impact to an area. Sensitivity refers to the qualities of an area, including the completeness of the view and perceived value. Magnitude is the nature of the project and refers to the magnitude of change and extent/proximity of the change to the view as a result of the proposal. Combined, these factors form an impact rating.

Table 6-38 Landscape Character and Visual Impact Matrix

<table>
<thead>
<tr>
<th>SENSITIVITY</th>
<th>MAGNITUDE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Moderate</td>
<td>High-moderate</td>
</tr>
<tr>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>Negligible</td>
<td>Negligible</td>
</tr>
</tbody>
</table>

For the purposes of the landscape character assessment, the study area was divided into four key character zones. Figure 6-31 shows the extent of each landscape character zone within the study area, including:

- Mixed residential
- Mixed commercial
- Mixed residential
- Urban road corridor

The visual impact assessment is based on the range of selected viewpoints and visual envelope, shown in Figure 6-31. Overall visibility is assessed and presented in the visual impacts section of this chapter.
Fig. 6.27

Landscape character zones and viewpoints

LEGEND

Character zones

Viewpoint

Zone 1 - Mixed residential
Zone 2 - Mixed commercial
Zone 3 - Mixed residential
Zone 4 - Urban road corridor

Water main adjustments

Vector backdrop data © MDS 2017, public_NSW_Imagery: © Land and Property Information 2015

Last updated by: DW13219 on 24/04/2017 at 17:14
6.6.2 Existing environment

Vehicles travel in an easterly/northerly and westerly/southerly direction along the Princes Highway. Off roads from the highway include the Old Princes Highway (to the west) and Kingsway (to the east). A range of side streets also provide access to suburban and commercial areas. Commercial property (including McDonalds Kirrawee) between Oak Road and Bath Road can be accessed via twin access roads.

Bus interaction with the highway is limited, as government and private bus services operate alternate routes in the study area (refer to Section 2.2.5). Kirrawee railway station is located on Oak Road, about 300 metres south of the highway.

Cycle access is not specifically catered for in the study area and pedestrian access to the highway is relatively standard and discontinuous. Crossings are located between 500 metres and 1000 metres apart and are currently on one side of each intersection only. The service road between Acacia Road and Oak Road is a shared pathway utilised by pedestrians, cyclists and cars.

Key stakeholder sites have been identified where mitigation measures would be required to manage impacts of the proposal. Changes to the visual amenity and function of the study area would impact stakeholders including:

- Bupa Aged Care
- Car sales yards along Princes Highway, including Tynan Subaru, and Sutherland Toyota
- McDonalds Kirrawee
- Residences
- Proposed child care centre

Existing Landscape character zones

*Landscape character impact zone 01: Mixed Residential*

LCZ1 is characterised by single-lot and multi-residential development. An aged care facility and commercial car sales yard are notable features within this LCZ. Landscaped communal and private gardens are present across LCZ1, with buildings amongst them behind generous setbacks.

Road users are able to avoid the highway by using the local road network and service roads to access properties. Footpaths are considered narrow along local roads, connecting with service roads parallel to the Princes Highway.
Figure 6-32 Multi-residential development with landscaped frontage at the intersection of Princes Highway and Old Princes Highway

Figure 6-33 Partial road closure at end of Acacia Road looking south towards Princes Highway
Car yards and a lack of vegetation comprise LCZ2. There are limited street trees on local roads behind the development fronting the highway. The skyline is dominated by overhead utilities and a large multi-residential development is under construction on the southern side of the highway.

Driveways and service roads provide access to properties off the highway and from the local road network. Narrow and discontinuous footpaths are a key element in this LCZ.
Figure 6-35 Commercial car yards along Princes Highway

Figure 6-36 Commercial access along Princes Highway
Figure 6-37 Commercial access along Princes Highway

**Landscape character impact zone 03: Mixed Residential**

Located along the southern verge of the Princes Highway, residential dwellings front the highway. There are additional two and three-storey multi-residential buildings behind properties fronting the highway.

The Princes Highway is relied upon for access in this LCZ, as well as other arterial roads. Although increased access provides a more urbanised atmosphere, pedestrian engagement with the precinct is limited to discontinuous footpaths and scattered setbacks.

Figure 6-38 Single-storey dwellings converted to businesses fronting highway
Figure 6-39 Grove of existing trees (local heritage item) at corner of Princes Highway and Kingsway

Figure 6-40 Multi-residential property with vegetated setback
**Landscape character impact zone 04: Urban Road Corridor**

LCZ4 is comprised of a broad arterial road which is constantly used as a link between Sydney and Wollongong. A small section of the Kingsway which provides access to the suburb of Cronulla also forms a part of the urban road corridor.

Hard pavement, commercial and residential development, intersections, road furniture and overhead utilities dominate the road landscape.

Figure 6-41 Commercial sites with generous setbacks along highway
Existing Viewpoints

**Viewpoint 1**

Viewpoint 1 consists of the intersection of the Old Princes Highway and Princes Highway (Acacia Road) looking north east.
**Viewpoint 2A**
Viewpoint 02A looking west along the northern verge and parallel service road.

**Viewpoint 2B**
Viewpoint 02B looks west along the northern verge and parallel service road.

**Viewpoint 3a**
The view is from the north west corner of the intersection of the Princes Highway with Oak Road looking west.
Viewpoint 3b
Looking east along the northern verge and parallel service road, the view is of the north west corner of the intersection of the Princes Highway with Oak Road.

Viewpoint 4
Off the Princes Highway between Oak Road and Bath Road, the view is looking west along the northern verge and across an access driveway.
**Viewpoint 5**

This viewpoint looks north to north east across the intersection, and is located on a traffic island at the Princes Highway and Kingsway intersection.
6.6.3 Potential impacts

Landscape character zones

Landscape character zones characterise various land use, topography and vegetation sectors within the study area. The highest impact on character has been identified as Moderate, due to the proximity of single-lot residential residents fronting the highway (LCZ 1). The removal of trees and reduction in landscape service road verges increases the level of impact. The degree of impact on each zone in response to the proposal have been identified in Table 6-39.

Table 6-39 Landscape Character Zone Impacts

<table>
<thead>
<tr>
<th>Landscape Character Zone</th>
<th>The Proposal</th>
<th>Sensitivity</th>
<th>Magnitude</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Mixed Residential</td>
<td>Tree removal and new pavement construction would occur as a result of widening the Princes Highway. The vegetation removal between Auburn Street and Acacia Road would impact the LCZ as some trees are large. On the north western side of the intersection towards Oak Road, pavement widening would bring forth the requirement of retaining walls and localised regrading. The leafy character of the immediate area would be impacted by the proposal. Trees would be removed including those which form part of a heritage item, which contributes to the character of the broader area of Kirrawee.</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partly commercialised mixed with suburban residences</td>
<td>Widening along all of northern verge reducing setbacks</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local road network including service roads</td>
<td>Retaining structures facing residential properties</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Suburban vegetated character.</td>
<td>Service road adjustments</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Fencing and barriers</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Vegetation removal including street trees.</td>
<td></td>
</tr>
<tr>
<td>Landscape Character Zone</td>
<td>The Proposal</td>
<td>Sensitivity</td>
<td>Magnitude</td>
<td>Impact</td>
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</tr>
<tr>
<td>02 Mixed Commercial</td>
<td>Widening of the Princes Highway would require tree removal, a reduction in setbacks and new pavement construction.</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mainly commercial sites</td>
<td>Widening along sections of northern verge reducing setback</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local road network including service roads and driveways</td>
<td>Driveway adjustments</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Generous setbacks</td>
<td>Fencing and barriers</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poorly vegetated.</td>
<td>Vegetation loss including street trees.</td>
<td></td>
</tr>
<tr>
<td>03 Mixed Residential</td>
<td>A small section of work is located within a road reserve park on the northern side of the intersection with the Kingsway. Many mature Eucalyptus species are present in this well vegetated reserve. Trees within this LCZ form part of a locally listed heritage item, and their removal would impact local premises along the southern verge.</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mainly mix of multi-residential and single lot residential</td>
<td>Widening along section of southern verge reducing setback</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local road network link to highway</td>
<td>Service road adjustments</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Vegetated road reserves</td>
<td>Vegetation loss including street trees listed as local heritage item.</td>
<td></td>
</tr>
<tr>
<td>04 Urban Road Corridor</td>
<td>New drainage infrastructure, tree removal and new pavement construction, including</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate to low</td>
</tr>
</tbody>
</table>
line marking and road furniture would be included in the widening along Princes Highway. Signal and sign posts would be relocated due to modified intersection geometry. The vegetated roadside character would benefit viewers and road users where vegetation is intrinsic to the local area.

### Viewpoints

Six viewpoints were identified that reflect areas of key visual impacts from the proposal. Overall impact ratings for these viewpoints range from high to moderate to low, in respect to the viewers affected by the proposal. The western end of the project is most likely to experience the highest visual impacts. This is primarily due to the proximity of residential properties to the highway and vegetation removal. These impacts are discussed further in Table 6-40.

#### Table 6-40 Visual Impact assessment viewpoints

<table>
<thead>
<tr>
<th>VAP/V</th>
<th>Visible elements of the upgrade</th>
<th>Affected Viewers</th>
<th>Description of impacts</th>
<th>Sensitivity</th>
<th>Magnitude</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Trees would be removed as a result of the proposal and new pavement would be constructed. Retaining walls may be required as a result of the</td>
<td>Staff and residents at the Bupa Aged Care Facility from elevated positions behind</td>
<td>Views of widened road footprint along northern verge and vegetation removal</td>
<td>Moderate</td>
<td>High</td>
<td>High to moderate</td>
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</tr>
<tr>
<td>VAP/V P</td>
<td>Visible elements of the upgrade</td>
<td>Affected Viewers</td>
<td>Description of impacts</td>
<td>Sensitivity</td>
<td>Magnitude</td>
<td>Impact</td>
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</tr>
</tbody>
</table>
|         | widening and regrading of existing embankments facing residential properties would occur. | vegetated setback  
- Staff and clients at a commercial car yard from ground level and elevated positions on far side kerb  
- Residents of multi-level apartment buildings from elevated positions on far side verge  
- Residents of single-lot residences behind vegetated setback below level of road  
- Pedestrians and cyclists  
- Road users. | • Realigned service road encroaching towards private property  
• Retaining walls (<1m, in fill) and barriers would be visible  
• Landscaping of reduced verge  
• Removal of mature native trees would reduce the visual and physical buffer between the existing residences and the highway | • Local road network including service roads  
• Suburban vegetated character. | residential properties  
• Service road adjustments  
• Fencing and barriers  
• Vegetation removal including street trees. |
| 02A     | The proposal would see widening along Princes Highway requiring tree removal immediately west of Peach Tree Lane. Retaining walls | Residents of multi-level apartment buildings from elevated positions on far side verge | • The widening of the carriageway along the northern verge, associated retaining walls and realignment  
• Suburban residences  
• Local road network | Moderate  
• Suburban residences  
• Local road network | High  
• Widening along northern verge and service road reducing setbacks in | High to moderate |
<table>
<thead>
<tr>
<th>VAP/V</th>
<th>Visible elements of the upgrade</th>
<th>Affected Viewers</th>
<th>Description of impacts</th>
<th>Sensitivity</th>
<th>Magnitude</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>02B</td>
<td>The proposal would include the widening along Princes Highway and realignment of existing parallel service roads. This would result in tree removal on both sides of Oak Road and on some parallel service roads. The construction of retaining walls and regrading of existing embankments would occur in response to the pavement widening.</td>
<td>• Staff and clients of a service station and a commercial car yard (currently vacant) from ground level and elevated positions on far near kerb • Residents of multi-level apartment buildings from elevated</td>
<td>• Views of widened road footprint along northern verge • Retaining walls (&lt;1m, in fill) and barriers would be visible and opposite residences • Removal of mature native trees would reduce the visual and physical</td>
<td>Moderate • Partly commercialised mixed with suburban residences • Local road network including service roads • Suburban vegetated character.</td>
<td>High</td>
<td>High to moderate</td>
</tr>
</tbody>
</table>

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Gateway to the South Pinch Points Program, Princes Highway, Acacia Road, Oak Road and Kingsway, Kirrawee
Review of Environmental Factors
<table>
<thead>
<tr>
<th>VAP/VPP</th>
<th>Visible elements of the upgrade</th>
<th>Affected Viewers</th>
<th>Description of impacts</th>
<th>Sensitivity</th>
<th>Magnitude</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>03A</td>
<td>Tree removal and new pavement construction would occur in conjunction to the widening of the highway. Pavement widening adjacent to the curtilage of the highway on the western side would require retaining walls and regrading of embankments. Service roads that are parallel with the proposed widening would also require realignment, encroaching towards private property.</td>
<td>• Staff and clients of a service station and a commercial car yard (currently vacant) from ground level and elevated positions on the opposite side of the road • Residents of multi-level apartment buildings from elevated positions on far side verge</td>
<td>• Views of widened road footprint along northern verge • Realigned service road encroaching towards private property • Retaining walls (&lt;1m, in fill) and barriers would be visible and opposite residences • Removal of mature native trees would reduce the visual</td>
<td>Moderate • Partly commercialised mixed with suburban residences • Local road network including service roads • Suburban vegetated character.</td>
<td>High</td>
<td>High to moderate</td>
</tr>
</tbody>
</table>

- Vegetation removal including street trees.
<table>
<thead>
<tr>
<th>VAP/V P</th>
<th>Visible elements of the upgrade</th>
<th>Affected Viewers</th>
<th>Description of impacts</th>
<th>Sensitivity</th>
<th>Magnitude</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>03B</td>
<td>The widening of the Princes Highway would require the removal of trees on both sides of Oak Road, as well as recently planted street and palm trees on the existing verge. Setbacks to commercial properties would be reduced and a new pavement would be constructed.</td>
<td>• Staff and clients of a commercial car yard (currently vacant) from elevated positions on near kerb&lt;br&gt; • Residents of multi-level apartment buildings from elevated positions on far side verge behind vegetated setback&lt;br&gt; • Residents of multi-level apartment buildings from</td>
<td>• Views of widened road footprint along northern verge and vegetation removal would have reduced screening&lt;br&gt; • Modified driveway and parking&lt;br&gt; • Physical proximity of future child care centre to the highway</td>
<td>Low&lt;br&gt; • Mainly commercial sites with generous setbacks&lt;br&gt; • Poorly vegetated.</td>
<td>Moderate&lt;br&gt; • Widening along all of northern verge reducing setbacks&lt;br&gt; • Driveway adjustments&lt;br&gt; • Vegetation removal including street trees.</td>
<td>Moderate to low</td>
</tr>
<tr>
<td>VAP/V P</td>
<td>Visible elements of the upgrade</td>
<td>Affected Viewers</td>
<td>Description of impacts</td>
<td>Sensitivity</td>
<td>Magnitude</td>
<td>Impact</td>
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</tr>
<tr>
<td>04</td>
<td>Tree removal and pavement construction would occur as a result of the proposal. Additional slip lanes servicing commercial property driveways and access roads are proposed, resulting in pavement widening.</td>
<td>elevated positions on far side verge (future) • Residents of single-lot residences behind vegetated setback below level of road • Pedestrians and cyclists • Road users.</td>
<td>Views of widened road footprint along northern verge and vegetation removal • Modified driveways • Relocated VMS furniture • Landscaping of verge.</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate to low</td>
</tr>
</tbody>
</table>

Gateway to the South Pinch Points Program, Princes Highway, Acacia Road, Oak Road and Kingsway, Kirrawee
Review of Environmental Factors
<table>
<thead>
<tr>
<th>VAP/VP</th>
<th>Visible elements of the upgrade</th>
<th>Affected Viewers</th>
<th>Description of impacts</th>
<th>Sensitivity</th>
<th>Magnitude</th>
<th>Impact</th>
</tr>
</thead>
</table>
| 05    | New pavement construction and widening along the Princes Highway would result in pavement widening on the eastern side of the intersection. This would allow for the widening of the road and result in the removal of large native trees near residential properties. | • Staff and clients of a commercial car yard) from ground level and elevated positions on far side kerb  
• Staff and clients of single storey commercial properties from ground level positions on far side kerb  
• Residents of multi-level apartment buildings from elevated positions behind. | • Views of widened road footprint along southern verge and vegetation removal  
• Realigned and widened footpath  
• Landscaping of verge. | Low  
• Mainly commercialised mixed with residences  
• Suburban vegetated character. | Low  
• Widening along part southern verge reducing setback  
• Footpath adjustments  
• Vegetation removal including street trees. | Low |
<table>
<thead>
<tr>
<th>VAP/V P</th>
<th>Visible elements of the upgrade</th>
<th>Affected Viewers</th>
<th>Description of impacts</th>
<th>Sensitivity</th>
<th>Magnitude</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>vegetables setback</td>
<td>Pedestrians and cyclists</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Road users.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The visual impact analysis has identified seven viewpoints, from which visual impacts resulting from the proposal can be demonstrated. The impact ratings range from High-Moderate to Low, which is due to the type of viewer at these locations as the extent and nature of the proposal is fairly consistent along its length.

Similarly to character impacts, the highest impacts would be experienced at the western end of the proposal, due to the proximity of residential properties. These properties would experience visual and physical impacts due to widening of the highway and realignment of parallel service roads, which would encroach towards these properties. Vegetation removal in these sections of the proposal, along with the need for a retaining wall would contribute to the visual impacts.

Residents that experience views from elevated positions and properties with vegetated setbacks would be impacted by the proposal to a minor extent. Residents in the future South Village development to the east of Oak Road on the southern verge would most likely view the proposal after construction and many would look over and beyond the proposal from upper levels.

Through the central and eastern sections of the proposal, impacts would be lesser, in the range of Moderate-Low to Low due to the increased proportion of commercial properties with less sensitive viewers and generous setbacks.

The intent of the proposal aims to produce a design outcome that fits sensitively with the existing qualities and characteristics of the area. In order to achieve this, a range of mitigation measures have been incorporated into the project as the design has developed. These measures combine to develop a solution that seeks to protect and enhance the existing visual character of the area and minimise impacts on neighbouring properties.

**Urban design**

Consistent with the design objectives outlined in Section 3.2.2, the ESC - Princes Highway Urban Design report (AECOM, 2017) provides guidance on how these principles are to be applied in developing the detailed design of the public domain, and the elements within it.

**Retaining walls**

Two retaining walls would be provided on the northern side of the Princes Highway between from just past the Bupa Aged Care facility to Acacia Road North (this will be directly adjacent to the road carriageway) and from Acacia Road North to Oak Road (along the service road). These retaining walls face towards existing residential properties. The walls have a total length of about 400 metres, with a maximum height of 2.5 metres and average height of 1.6 metres. The extent of wall is shown in (refer to Figure 3-3 and Figure 3-4). The walls need to meet the mandated crash impact criteria.
The proposed design principles and detailing of the retaining walls would be confirmed during detailed design and guided by the following requirements:

- Satisfying the technical requirements to ensure safe and efficient operation of the roadway
- Minimising the construction footprint of the project
- Application and adherence to the relevant Austroads and Roads and Maritime design guidelines and practice notes
- Providing amenity and quality to the public domain and carriageway corridor
- Maintaining operational flow to the existing traffic network during construction.

The design and finishes of the retaining wall structures would to consider the interface with residential lots. The walls should be well detailed and recessive to limit the visual impact.

The following urban design criteria would be applied to develop the detailed design and achieve the design principles. This includes:

- Retaining walls and related elements being designed as a unified composition and be integrated with other components such as guard rails.
- Good quality, modular concrete fascia or cladding systems may be used to increase the aesthetic appeal of retaining walls, introduce a pattern or rhythm, and reduce their apparent scale and visual impact.
- Tops of walls are to be finished with a long, gradual and consistent curve and be free from sudden steps or changes in level.
- Simple planting should be provided in front of retaining walls at every opportunity to soften the outcome for the adjacent residents.
- Wall design considers minimising and discouraging graffiti vandalism, as well as the long term maintenance strategy.
A Shared Way is proposed on the north side of the Princes Highway between Acacia Road and Oak Road. The shared way is 390 metres long and varies in width but typically five metres wide (refer to Figure 6-45).

The primary objectives of the urban design at the shared zone include:

- Providing priority for pedestrian movements
- Achieving lower vehicle speeds
- Reduced severity of any pedestrian injuries from vehicle impacts
- Improved amenity for pedestrians and residents
- Provide visitor parking bays

Figure 6-44 Artists impression retaining wall (looking east)
To assist with defining the space and increasing safety the following urban design criteria would be applied in developing the proposed treatments to the shared zone:

- Junctions where traffic can move from residential roads onto the shared zone would be clearly defined with raised threshold highlighted by coloured brickwork pavement indicating a change in driving conditions
- Raised speed calming islands planted with ground covers would also occur along the shared zone to aid in traffic calming.
- Legible and visible speed signs would be used to clearly define the beginning of shared zone and will occur frequently along the shared zone

Figure 6-45 Artists impression shared zone (looking east)

**Planting**

The design objectives for the project include providing a continuous ‘green’ corridor wherever possible, to maintain and enhance the character of the highway and adjacent areas. Due to the constrained space available and the presence of overhead wires within the project boundary, the ability to replace removed vegetation would be limited at areas of engineering constraints.

Landscape character impact zone 1 (the residential precinct between the intersections of Auburn St and Oak Road) has been assessed as having an impact rating of moderate. Providing planting in this area would be considered during detailed design with the aim to soften the appearance of the retaining wall. Successful planting in front of the two
proposed north facing retaining walls would consider implementation of one or a mix of the following:

- Tall slender planting to screen the Princes Highway and not limit movements along the shared way or impede traffic movements along the highway.
- Proposed planting under powerlines to comply with the minimum clearance requirements to minimise requirements for pruning
- Low ground cover boarder planting to formalize the area and create a sense

Width constraints along the shared way result in a narrow planting bed at the base of the retaining wall. Due to the limited soil volume and northern aspect, access to water would be the key for success of any planting. Appropriate species would be selected to maximize screening potential but not impede on traffic movement of either the shared way of the adjacent Princes highway.

Due to a number of site constraints (e.g. underground utilities, overhead wires, clear zone, narrow verge), the 5:1 tree replacement required by the Council would not be met. However, tall shrubs would be planted to provide screening and buffer wherever possible.

### 6.6.4 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual amenity</td>
<td>Landscaping is to be managed in accordance with the <em>Roads and Maritime Services Landscape guideline</em>, 2008.</td>
<td>Contractor</td>
<td>Construction/Post construction</td>
<td>Additional standard safeguard V2</td>
</tr>
<tr>
<td>Tree removal and re-planting</td>
<td>A landscaping plan will be developed in consultation with Sutherland Shire Council prior to Construction and will include detail on the planting species mix and consideration of translocation of tree saplings.</td>
<td>Roads and Maritime/Contractor</td>
<td>Pre-construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Visual amenity</td>
<td>Works to be carried out in accordance with EIA-N04 <em>Guideline for Landscape Character and visual impact assessment</em> and mitigation measures proposed in the technical paper in Appendix F.</td>
<td>Contractor</td>
<td>Construction/Post construction</td>
<td>Additional standard safeguard V5</td>
</tr>
</tbody>
</table>
6.7 Socio-economic

6.7.1 Methodology
The socio-economic assessment addresses the requirements of *Environment Impact Assessment Practice Note – Socio Economic Assessment (EIA No. 5)* for a ‘Moderate level’ assessment. Quantitative and Qualitative data was collated to develop a thorough understanding of the socio-economic environment within and surrounding the study area.

6.7.2 Existing environment

Demographic characteristics:

In 2011, the Kirrawee population was 8,977, comprising just over four per cent of the Sutherland LGA population (ABS, 2011). The study area is characterised by single and multi-story dwellings, commercial properties fronting and surrounding the Princes Highway and various small green spaces. Table 6-41 summarises the key demographic characteristics of Kirrawee and the Sutherland LGA.

Table 6-41 ABS demographic characteristics in 2011

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Kirrawee</th>
<th>%</th>
<th>Sutherland LGA</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total population</td>
<td>8977</td>
<td>-</td>
<td>210863</td>
<td>-</td>
</tr>
<tr>
<td>Proportion of people aged 14 years or younger</td>
<td>1733</td>
<td>19%</td>
<td>40372</td>
<td>19%</td>
</tr>
<tr>
<td>Proportion of people aged 65 years or older</td>
<td>1637</td>
<td>18%</td>
<td>31423</td>
<td>15%</td>
</tr>
<tr>
<td>Advantage/disadvantage index by decline (NSW average 1000)</td>
<td>1046</td>
<td>-</td>
<td>1083</td>
<td>-</td>
</tr>
<tr>
<td><strong>Households</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total households</td>
<td>3382</td>
<td>-</td>
<td>75349</td>
<td>-</td>
</tr>
<tr>
<td>Average household size</td>
<td>2.6</td>
<td>-</td>
<td>2.7</td>
<td>-</td>
</tr>
<tr>
<td>Housing tenure - Mortgage</td>
<td>$2,496</td>
<td>-</td>
<td>$2,400</td>
<td>-</td>
</tr>
<tr>
<td>Housing tenure - Rent</td>
<td>$330</td>
<td>-</td>
<td>$370</td>
<td>-</td>
</tr>
<tr>
<td>Median household income ($)</td>
<td>$1,387</td>
<td>-</td>
<td>$1,674</td>
<td>-</td>
</tr>
</tbody>
</table>
Residential properties

Residential properties are present along the Princes Highway, particularly between Acacia Road and Oak Road. Properties fronting onto the Princes Highway include Low Density Residential (R2) on the southbound side and High Density Residential (R4) on the northbound side between Acacia Road and Oak Road. Medium Density Residential land is present on the northbound side of the Princes Highway from Bath Road to Hotham Road, at the Kingsway intersection.

Social infrastructure

Community services and facilities are present across the study area and suburb of Kirrawee. Catering for the needs of both local and regional communities, the following facilities are available:

- Education facilities, including Kirrawee Public School and St Patricks College
- Religious and cultural facilities, including President Avenue Community Church, Soul Revival Church and Saint Stylianos Greek Orthodox Church
- Kirrawee Railway Station
- Sport and recreation facilities, including the Royal National Park, Sutherland Shire Leisure Centre and Woronora Memorial Park
- Local shopping facilities, including McDonalds Kirrawee, various car dealerships and service stations
- Health and medical facilities, including Bupa Aged Care Sutherland and President Private Hospital
- Other community facilities include, Sutherland library, Sutherland Entertainment Centre and Club Kirrawee.

<table>
<thead>
<tr>
<th>Same address 5 years ago as in 2010</th>
<th>5318</th>
<th>64%</th>
<th>125573</th>
<th>64%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel to work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel to work by car (as driver - one method)</td>
<td>2517</td>
<td>57%</td>
<td>67161</td>
<td>61%</td>
</tr>
<tr>
<td>Travel to work by car (as passenger - one method)</td>
<td>187</td>
<td>4%</td>
<td>4390</td>
<td>4%</td>
</tr>
<tr>
<td>Travel to work by walking or cycling (one method)</td>
<td>124</td>
<td>3%</td>
<td>861</td>
<td>1%</td>
</tr>
</tbody>
</table>
Community values

The Sutherland Shire Council vision aims for “a connected and safe community that respects people and nature, enjoying active lives in a strong local economy” (Sutherland Shire Strategic Plan 2011).

Primary strategies listed in the Sutherland Shire’s Strategic Plan (2011) include:

- Provide effective and integrated infrastructure
- Deliver integrated transport options
- Conserve natural resources
- Protect our environment
- Strengthen our community
- Respect and value all heritage and culture

The community of Sutherland Shire utilise the Princes Highway and Oak Road as the main thoroughfare for people travelling between Wollongong and the Sydney CBD. The Sutherland Shire Strategic Plan, 2011 (Strategic Plan) emphasises the value that the Sutherland population place on working locally to maintain a positive work life balance. Access is a key component of living active lifestyles within the Sutherland Shire. Being in such close proximity to recreational facilities such as the Royal National Park, it is expected from the primary strategies and considerations listed in the Strategic Plan that the community values the environment, being active and experiencing a high level of access across the Sutherland Shire.

Access and connectivity

The Princes Highway is the main road through Kirrawee connecting traffic from Gymea to the east and Sutherland to the west of the proposal. Existing access and connectivity options for the Kirrawee population include:

- Rail: Kirrawee Railway Station is the primary railway station in Kirrawee around three kilometres away from the proposal on Oak Road. Gymea Station and Sutherland Station are both about 1.3 kilometres away from Kirrawee Railway Station to east and west respectively

- Road: Although the Princes Highway is the main road connecting various suburbs within the Sutherland Shire, it also serves as an arterial road for residential and commercial properties

- Buses: There are around 15 bus routes that currently travel through or in close proximity to the proposal area. Bus routes are outlined in Figure 2-7 and Figure 2-8

- Cycling and walking: The current design of the Princes Highway includes one shared access path for cyclists and pedestrians between Oak Road and Acacia Road. In some cases, intersections are limited to crossings on one side of the road only and footpaths are relatively narrow or discontinuous. Service roads running parallel with the Princes Highway act as informal shared paths for cyclists, pedestrians and residents
• Parking: There is currently no parking on the Princes Highway. There is road-side parking within the surrounding road network including Oak Road, Flora Street, Bath Road, Orana Avenue, Monroe Avenue and Auburn Street.

Local business and industry

Commercial properties exist along both sides of the Princes Highway. Businesses within the study area cater for both residential and regional customers passing through Kirrawee.

The existing Kirrawee Shopping Village is located on Oak Road, about 200 metres south of the proposal. The shopping village includes a variety of local businesses as well as a post office. The Deicorp residential development ‘South Village’ is being developed on the corner of the Princes Highway and Oak Road. The development is proposed to include 749 residential apartments and 14,000m² of retail space consisting of restaurants, cafes and two supermarkets (Coles and Aldi). An additional development has been proposed in Flora Street next to the Deicorp development, which would consist of a Woolworths supermarket, liquor store, childcare centre, cafes and commercial offices.

North east of the Oak Road and Princes Highway intersection consists mainly of residential housing (about 210 dwellings) with the exception of the Four Square Stores (Food Retail) located at the south eastern corner of the Waratah Street and Acacia Road intersection and the Kirrawee bowling and recreation club located at 101 Oak Road, Kirrawee.

North of Flora Street consists mainly of residential apartments and the Donald Robinson Retirement Village. A BP Service Station is located at the corner of Princes Highway and Oak Road. South of Flora Street consists of residential housing as well as some apartments and townhouses. The Fauna Place Child Care centre is located at Lot 30, Fauna Place, Kirrawee. A number of local stores and restaurants (Kirrawee Shopping Centre) are located along Oak Road south of Flora Street and north of the railway line. The Australia Post – Kirrawee branch is also located within the Kirrawee Shopping Centre.

South of Flora Street and north of the T4 railways line contains the Oak Road local stores to the west (Kirrawee Shopping Centre). A church is located in this area as well as the Kirrawee Railway Station.

East of the new development and south of Flora Street, consists of a number of industrial stores / businesses.

Some of the industrial and commercial businesses located near the proposal are listed in Table 6-42.
Table 6-42 Industrial and commercial businesses

<table>
<thead>
<tr>
<th>Region 2 industrial and commercial businesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tynan Motors Kirrawee Service Centre</td>
</tr>
<tr>
<td>KIRRrawee Bunnings Warehouse</td>
</tr>
<tr>
<td>Dominelli Ford and Renault</td>
</tr>
<tr>
<td>McDonald’s Kirrawee</td>
</tr>
<tr>
<td>GYC Mower Depot Kirrawee</td>
</tr>
<tr>
<td>ABS Auto Kirrawee</td>
</tr>
<tr>
<td>Sutherland Mazda</td>
</tr>
<tr>
<td>Cronulla Car Sound</td>
</tr>
<tr>
<td>NRP Motorcycles</td>
</tr>
<tr>
<td>Zax All Kars</td>
</tr>
<tr>
<td>AAP Industries</td>
</tr>
<tr>
<td>The Tool Store</td>
</tr>
<tr>
<td>Pool and Spa Warehouse and Shire Gymnastics</td>
</tr>
<tr>
<td>Mitchells Motorcycles</td>
</tr>
<tr>
<td>Davell Products Pty Limited</td>
</tr>
<tr>
<td>Sutherland Shire Auto Centre</td>
</tr>
<tr>
<td>Tubbys Tyrepower</td>
</tr>
<tr>
<td>Great Stone Tiles &amp; Bathware</td>
</tr>
<tr>
<td>Shire Steel and Fabrication</td>
</tr>
<tr>
<td>Go Electrical Kirrawee</td>
</tr>
<tr>
<td>Streamline Boat Covers</td>
</tr>
<tr>
<td>American Vogue</td>
</tr>
<tr>
<td>Kirrawee Auto Electrics</td>
</tr>
<tr>
<td>House of Party</td>
</tr>
<tr>
<td>Blue Tongue Campers</td>
</tr>
<tr>
<td>Little Fins Swim School</td>
</tr>
<tr>
<td>Simon McMahan Automotive Pty Ltd</td>
</tr>
<tr>
<td>Rudis Continental Butchery Pty Ltd</td>
</tr>
<tr>
<td>Hudson Building Suppliers Kirrawee</td>
</tr>
<tr>
<td>Cronulla Sutherland Automatics</td>
</tr>
<tr>
<td>Ron Spink Automotive</td>
</tr>
<tr>
<td>Kirrawee Pharmacy</td>
</tr>
<tr>
<td>Tradelink</td>
</tr>
<tr>
<td>Kirrawee Automatics &amp; Gear Boxes</td>
</tr>
<tr>
<td>Fruitfull</td>
</tr>
<tr>
<td>Lucky 7 Convenience Shop</td>
</tr>
<tr>
<td>Walkers Party Hire Kirrawee</td>
</tr>
<tr>
<td>The Brew Shop Kirrawee</td>
</tr>
<tr>
<td>Kirrawee Cycles</td>
</tr>
<tr>
<td>Kirrawee Pic-A-Pet</td>
</tr>
</tbody>
</table>

6.7.3 Potential impacts

Construction

Property impacts

No property acquisition would be required for the proposal. Residential properties between Auburn Street and Oak Road are likely to be most impacted by the proposal. The works would occur on both sides of the highway, however the road would only be widened on the northbound side. As a result of the widening, changes to the service road would occur and properties would be closer to the road. It is likely that properties would be exposed to increased temporary noise and dust from construction activities. Mitigation measures to minimise noise impacts and control air pollution such as dust would be employed during construction.

Travel behaviour

During construction, it is expected that traffic delays would occur in response to changes in access and connectivity. Reduced speed limits around construction sites would result in increased travel time for all road users. Figure 6-12 to Figure 6-14 outline alternative routes for traffic.
**Access and connectivity**

Changes in access would impact residents within the study area and are explained in Section 6.2.3.

Road users would be required to travel slightly longer distances and are likely to initially become frustrated by the additional travel time. Residents who utilise the service roads parallel to the Princes Highway for property access would be impacted the most. Access into the service road from the Princes Highway would be removed at Kenneth Avenue. Figure 6-12 to Figure 6-14 outline alternative routes for traffic. Section 6.3.3 identifies specific properties that would be temporarily affected during the construction phase of the proposal.

**Social infrastructure**

The majority of community facilities fall outside the project boundary and would not be directly impacted during the construction phase.

**Businesses and industry**

Many of the businesses fronting onto the Princes Highway rely on visual exposure for business. Residents and road users may avoid accessing commercial properties in close proximity to construction sites to limit confusion and additional detours. During the construction phase, traffic delays and changes in access would potentially impact local shopping facilities, including those listed in Table 6.42.

Local businesses would also benefit from increased activity, including McDonalds Kirrawee, Kirrawee Shopping Village and the service stations. This is a benefit of the proposal as expenditure would have flow on effects to other businesses in the area.

**Local amenity**

Construction noise would impact residents, businesses and road users. Sensitive receivers in close proximity to the project works include private residences, Bupa Aged Care and Kirrawee Public School. As discussed in Section 6.4.5, construction noise would be managed consistent with the ICNG as detailed in a Construction Noise and Vibration Management Plan.

Earthworks would generate dust, particularly from vegetation removal and heavy machinery movement during the construction phase of the proposal. This would impact residents and road users within the vicinity of the proposal. Safeguards and mitigation measures with reference to dust are outlined in Section 6.10.2.

The proposal is likely to impact on the visual amenity of the road corridor. As reflected in the Sutherland Shire Council Community Plan (2011), the community enjoys nature and the environment. The removal of some trees may impact the visual amenity of the road corridor and surrounding properties.

**Compound sites**

Two compound sites have been assessed and it is proposed one of these sites would be utilised during the construction phase of the proposal (refer to Figure 3-17).
Both sites are in the suburb of Miranda and are in close proximity to residential properties. A minor increase in noise would potentially occur as a result of construction activities at these compound sites.

The compound sites would temporarily impact the visual amenity of the residential areas for the duration of the construction phase.

The increased presence of heavy vehicles entering and exiting the compound sites may contribute to traffic congestion from vehicles turning in and out of the sites. Access from Wandella Road would be limited due to the proximity to the traffic lights, therefore an alternate access point along The Boulevarde would be available for the Wandella Road/The Boulevarde compound site.

The Sylvania Road/Kingsway compound site would be difficult to access as there is currently no access from Kingsway and access from Sylvania Road would be close to the intersection, potentially causing delays. Alternatively, access from the layback at Lot 3 DP 9060 would be agreeable, as council owns Lot 2 DP 9060, Lot 3 DP 9060 and Lot 4 DP 9060 to the north of the proposed compound site. This would reduce congestion and traffic for road users travelling around the compound site.

Dust would potentially occur as a result of the construction vehicle and machinery movement at the compound sites. Mitigation measures would aim to address this impact as residential properties are in close proximity to the sites. A child care centre at the Wandella Road/The Boulevarde compound site is located directly to the west.

**Sydney Water installation**

The Sydney Water main upgrade to the west end of the proposal would be separated from pedestrian traffic. The installation would be confined to an area within the grassed section of the carpark on the Old Princes Highway.

**Operation**

**Property**

The proposal would result in commercial and residential properties on the south bound side of the highway to be closer to the Princes Highway. This is likely to increase the level of noise experienced by close receivers, however the noise assessment has identified that noise would not exceed 2dB (refer section 6.4). Visual impacts of the proposal would include the visual closeness of the highway and clearing of some vegetation. Safeguards have been identified to mitigate such impacts, and these impacts are thought to be offset by the improved connectivity and safety as a result of the proposal for all road users.

**Travel behaviour**

The proposal would improve travel time for road users of the Princes Highway through Kirrawee. The inclusion of additional slip roads and lanes would improve road safety and ease congestion.
A concrete footpath on the eastern side of Oak Road (northern approach) would be installed and the existing pedestrian crossing at the Acacia Road intersection would connect with the footpath along the Princes Highway along the western side of Acacia Road.

The improvement of road infrastructure associated with the Princes Highway would potentially encourage increased road activity by all road users.

The proposal would result in the removal of about 12 on street car parking spaces along Kingsway (refer to Figure 6-15). Due to Kingsway being a Roads and Maritime state owned road (highway or main traffic route), and the availability of off street and on street available parking for residences, the implementation of a formal No Stopping in the area shown in Figure 6-15 is considered to have negligible impacts.

**Access and connectivity**

Improvements in traffic flow and reductions in congestion would result from the proposal. Pedestrians would benefit from improved access across connected footpaths. Permanent removal of access between Kenneth Avenue and the Princes Highway and the removal of right-hand turns on Oak Road would increase the travel distance for road users through the use of detours. This would be offset by the improvement in congestion and traffic flow along the Princes Highway.

**Social infrastructure**

The proposal would result in improved travel conditions for the Kirrawee community. Social infrastructure facilities would not be impacted negatively by the proposal and would aim to improve accessibility and connectivity.

**Business and industry**

Businesses within and surrounding the proposal area would potentially benefit from the widening of the Princes Highway. Reduced travel times and improved connectivity would positively contribute to local businesses, particularly those fronting onto the Princes Highway. The development of the new Kirrawee shopping village bordered by Oak Road, Flora Street, Bath Road and the Princes Highway would benefit from the proposal.

**Amenity**

As the Princes Highway is a large arterial road, the proposal would not contribute to community severance and is aimed at improving congestion. Visual impacts are discussed in section 6.6.3 of this report.
### 6.7.4 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
</table>
| Socio-economic              | A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum):  
  - Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions, contact name and number for complaints.  
  The CP will be prepared in accordance with the *Community Involvement and Communications Resource Manual* (RTA, 2008).                                                                                           | Contractor     | Detailed design / pre-construction | Additional safeguard            |
| Construction related disruption | Access to residences and businesses would be maintained during construction. Where temporary changes to access arrangements are necessary, the contractor would advise owners and tenants and consult with them in advance with regard to alternative access arrangements.                                                                                      | Contractor     | Construction                     | Additional safeguard            |
| Construction related disruption | Affected residents and businesses would be notified of the progress of the works and advised in advance (e.g., by letterbox drop, meetings with individuals) of any access arrangements prior to each construction stage.                                                                                           | Contractor     | Construction                     | Additional safeguard            |
6.8 Waste and resource use

6.8.1 Policy setting

In addition to managing waste in accordance with the relevant legislation, Roads and Maritime manages waste according to the *NSW Waste Avoidance and Resource Recovery Strategy 2007* and the *NSW Waste Classification Guidelines* (DECCW, 2009) as summarised below.

**NSW Waste Avoidance and Resource Recovery Strategy 2007**

The *NSW Waste Avoidance and Resource Recovery Strategy* (DECC, 2007) (Waste Strategy 2007) aims to maximise conservation of natural resources and to minimise environmental harm from waste management and disposal of solid waste. To promote these objectives, the strategy identifies waste avoidance and resource recovery goals and targets in four key result areas:

- Preventing and avoiding waste
- Increasing recovery and use of secondary materials
- Reducing toxicity in products and materials
- Reducing litter and illegal dumping.

Broad targets for each of these key result areas are specified in Waste Strategy 2007. Of particular relevance to Roads and Maritime is the target by 2014, to increase recovery and use of materials from the construction and demolition sector, from 65 per cent (in 2000) to 76 per cent. The Waste Strategy 2007 targets form the basis for waste generation and recycling of construction materials for the proposal.

**NSW Waste Classification Guidelines**

The *NSW Waste Classification Guidelines* (DECCW, 2009) describe a number of pre-classified wastes and provide specific direction on the classification of waste, based on chemical composition and associated environmental impacts. Waste streams require different management, transportation and disposal depending on their classification.

6.8.2 Potential impacts

**Resource use**

The materials required for the proposed works would include, but not be limited to:

- Select material (recycled where possible)
- General fill material (recycled where possible)
- Roadbase material (recycled where possible)
- Asphal tic material
- Sand
- Concrete
- Rock
• Aggregate
• Fuel
• Reinforcement and structural steel.

These materials and any additional materials required for the proposal would be sourced and imported from commercial quarries and suppliers. These materials are not currently in short supply and it is not anticipated that the proposal would substantially increase the demand on these resources. Where possible, spoil from the proposed works would be recycled as fill on the proposal site.

**Waste management**

Waste generated during construction would primarily be from the demolition of existing structures to accommodate the road widening, excavation of existing pavement, civil works associated with site preparation, relocation of utilities, construction of road infrastructure and landscaping.

Waste-generating activities would include:

• Vegetation clearance, generating green waste such as logs and mulched material
• Construction of temporary construction compounds, ancillary sites, temporary drainage structure installation and the placement of gravel road base where required, generating general asphalt waste, pipe cuts and green waste
• Installation of environmental controls, fencing, and silt fences, generating material off-cuts
• Excavation of existing asphalt and concrete pavements and sub-grade
• General earthworks, placement of pavement layers, drainage, utilities placement and protection, installation of lighting, fencing and road furniture.

Waste materials would include:

• Asphalt pavement
• Concrete and brick
• Steel
• Soil and rock
• Contaminated soils that may be exposed (refer to Section 6.2)
• Surplus construction materials such as fencing, sediment, concrete, steel, formwork, and sand bags
• Packaging materials from items delivered to site, such as pallets, crates, cartons, plastics and wrapping materials
• Vegetative waste from clearance and grubbing
• Plant and vehicle maintenance waste, such as oil containers
• General office wastes such as paper, cardboard and food wastes
• Sewage waste generated through the use of personnel facilities.
The process for management of excess material would be detailed in a Resource and Waste Management Plan (RWMP) that would form part of the CEMP.

### 6.8.3 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste management</td>
<td>A Resource and Waste Management Plan (RWMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to support minimising the amount of waste produced and appropriately handle and dispose of unavoidable waste. The RWMP will be prepared taking into account the Environmental Procedure – Management of Wastes on Roads and Maritime Services Land and relevant Roads and Maritime Waste Fact Sheets.</td>
<td>Contractor</td>
<td>Pre-construction/Construction</td>
<td>Core standard safeguard Section 4.2 of QA G36 Environment Protection</td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
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</tr>
<tr>
<td>Waste management</td>
<td>Hierarchy of waste management would be implemented via:</td>
<td>Contractor</td>
<td>Construction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Separation of general wastes, recyclable/reusable materials, and hazardous wastes to avoid mixing with other materials/wastes.</td>
<td></td>
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<tr>
<td></td>
<td>• Regular housekeeping and servicing of waste storages</td>
<td></td>
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<tr>
<td></td>
<td>• General waste and recycling receptacles will be provided on site</td>
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<tr>
<td></td>
<td>• Waste would be transported to an appropriately licensed waste disposal and/or recycling facility</td>
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<tr>
<td></td>
<td>• Wastes (including green wastes) would not be burnt</td>
<td></td>
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<tr>
<td></td>
<td>• Weed removal activities including removal of weeds prior to tree removal works to allow non-weed infested mulched material to be reused on site.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Waste material left on site</td>
<td>Waste material, other than vegetation and tree mulch, is not to be left on site once the works have been completed.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard M7</td>
</tr>
<tr>
<td>Maintenance of working areas</td>
<td>Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working day.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard M8</td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
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</tr>
<tr>
<td>Material resourcing</td>
<td>Procurement will endeavour to use materials and products with a recycled content where that material or product is cost and performance effective.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Material resourcing</td>
<td>As far as practicable, construction materials would be sourced within the Sydney region so as to reduce transport costs, including fuel usage.</td>
<td>Contractor</td>
<td>Pre-construction/Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Waste management and disposal</td>
<td>Suitable waste disposal locations would be identified and used to dispose of litter and other wastes on-site. Suitable containers would be provided for waste collection.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>
6.9 Cumulative impacts

Cumulative impacts must be considered during the environmental impact assessment process to identify potential interaction with other projects and developments within the proposal area.

6.9.1 Study area

The study area consists of residential and commercial property and is based within the suburb of Kirrawee. As a part of the Sutherland Shire LGA, the study area is bordered by Sutherland to the west, and Gymea to the east. The three suburbs are linked by the Princes Highway, serving as the arterial road of the area.

6.9.2 Broader program of work

The intersection upgrade proposal at Princes Highway, Acacia Road, Oak Road and Kingsway is part of from the Gateway to the South pinch point program under the Easing Sydney’s Congestion Program Office. Projects that are occurring in the vicinity of the proposed works are shown in Figure 6-46 and includes:

- Proposed intersection improvements on the Princes Highway and President Avenue
- Proposed intersection improvements on the Princes Highway and The Boulevarde

Other projects include:

- Clearways program at the Princes Highway – President Avenue, Kogarah to King Georges Road, Blakehurst
- Current development of the ‘brick pit’ on the corner of the Princes Highway and Oak Road
- Proposed development on Flora Street, Woolworths Kirrawee, including a child care centre, cafes and commercial offices

Refer to Table 6-43 for additional information.
Legend:

1. Princes Highway & President Avenue, Kirrawee (subject to separate project approval)
2. Princes Highway, Old Princes Highway & Acacia Road North, Kirrawee (the proposal)
3. Princes Highway & Oak Road, Kirrawee (the proposal)
4. Princes Highway & The Kingsway, Kirrawee (the proposal)
5. Princes Highway & The Boulevarde, Kirrawee (subject to separate project approval)
### 6.9.3 Other projects and developments

Table 6-43 Past, present and future projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Construction impacts</th>
<th>Operational impacts</th>
</tr>
</thead>
</table>
| Gateway to the South - Pinch Point Program - Princes Highway & President Avenue, Kirrawee | - Widening on the south-eastern side of the intersection and into the existing median on the eastern side of the intersection  
- Lengthened right and left turn lanes from President Avenue, onto The Princes Highway  
- Removal of about 6 trees  
- Modification of the median on the northern side of the intersection to improve safety for vehicles turning right from President Avenue north bound  
- Relocating the traffic control signals in the existing median on the western side of President Avenue  | Construction impacts of the proposal may include:  
- Clearing of vegetation  
- Construction noise from the combined work along the Princes Highway in close proximity to sensitive receivers  
- Earthworks are likely to generate dust within the study area  
- The presence of construction vehicles and machinery would impact the visual amenity of the proposal area.  | Operational impacts of the proposal may include:  
- An increase in carrying capacity on the Princes Highway would result in increased vehicular activity.  
- Noise and vibration within the vicinity of the proposal.  
- Easing congestion and reduced delays at the intersection at President Avenue  
- Queuing and traffic blockages would be reduced  
- Upgraded footway leading to the intersection, improving pedestrian connectivity, safety and access.  
- The removal of six trees would result in the removal of some of the visual buffer between the railway line and President Avenue.  |
| Construction to commence in November 2017 (12 months duration) |                                                                                         |                                                                                                         |

| Gateway to the South - Pinch Point Program - Princes Highway & The Boulevarde, Kirrawee | Construction impacts of the project may include:  
- Clearing of vegetation  
- Construction noise from the combined work along the Princes Highway in close proximity to sensitive receivers  
- Earthworks are likely to generate dust within the study area  
- The presence of construction vehicles and machinery would impact the visual amenity of the proposal area.  | Operational impacts of the proposal may include:  
- An increase in carrying capacity on the Princes Highway would result in increased vehicular activity.  
- Increased noise and vibration within the vicinity of the proposal.  
- The removal of some trees would result in the removal a visual buffer |
|                                                                                         |                                                                                         |                                                                                                         |
**Highway south bound onto The Boulevarde**
- Tree removal
- Improving safety by restricting left turn access from The Princes Highway access road to The Boulevarde
- Construction of a traffic island to improve pedestrian safety and to separate left and right turning traffic from The Boulevarde into The Princes Highway

Construction to commence in mid-2018 (6 months duration)

machinery would impact the visual amenity of the proposal area.

between the road and properties fronting onto the road.

---

### Proposed Brick Pit development ‘South Village’ on the corner of Princes Highway and Oak Road – Deicorp residential development.

<table>
<thead>
<tr>
<th>Construction impacts from this proposal include:</th>
<th>Operation impacts from this proposal include:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Nosie and vibration impacts from construction activities including vehicles and machinery</td>
<td>- Additional residences and business patrons using on street parking</td>
</tr>
<tr>
<td>- Reduced access to surrounding properties</td>
<td>- Increased local road traffic entering the Princes Highway</td>
</tr>
<tr>
<td>- Increase in parking demand from construction workers</td>
<td>- Visual impacts of the new buildings</td>
</tr>
<tr>
<td>- Increase in delays around the proposal due to increased heavy vehicle activity and detours</td>
<td>- Increased pedestrian traffic travelling to and from Kirrawee Railway Station on Oak Road and the Princes Highway</td>
</tr>
<tr>
<td>- Earthworks and ground disturbance would need to be managed in accordance with safety standards and plans</td>
<td></td>
</tr>
</tbody>
</table>

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### Woolworths Kirrawee on Flora Street, including a childcare centre, cafes and commercial offices

<table>
<thead>
<tr>
<th>Proposed construction of a mixed use commercial development, including Woolworths supermarket, Dan Murphy's liquor store, commercial tenancies, childcare centre, parking and associated facilities.</th>
<th>Anticipated to commence prior to 2018. Construction impacts from this proposal include:</th>
<th>Operation impacts from this proposal include:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Nosie and vibration impacts from construction activities</td>
<td></td>
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</tr>
<tr>
<td>Increased vehicular activity around the mixed use commercial development and improved access</td>
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</tbody>
</table>
6.9.4 Potential impacts

<table>
<thead>
<tr>
<th>Environmental factor</th>
<th>Construction</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise and vibration</td>
<td>Noise impacts from the combined construction work along the Princes Highway would need to be mitigated in accordance with the relevant guidelines and safeguards. There are existing noise impacts associated with traffic flows on the Princes Highway.</td>
<td>With noise mitigation in place at all projects and developments occurring in close proximity to the study area, noise levels at all residences would be within the noise criteria.</td>
</tr>
<tr>
<td>Soil and water</td>
<td>Construction activities may experience spills or leakages of contaminants. These include fuels, chemicals and hazardous substances which have the potential to enter surface or groundwater or contaminating soils.</td>
<td>Spills or leaks of fuels, oils and other chemicals from vehicles utilising the road network have the potential to be washed into receiving waters after rainfall events if not appropriately controlled. The reduction of congestion and improvement in</td>
</tr>
<tr>
<td><strong>Construction activities</strong> have the potential to disturb contaminated land. Runoff during rainfall events or washing down of construction areas would potentially result in soil erosion. Rainfall on or runoff from erosion and sedimentation impacts can be minimised through the implementation of an erosion and sediment control management plan (ESCMP).</td>
<td><strong>travel time would reduce the amount of pollutants accumulating on the road surface.</strong></td>
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<tr>
<td><strong>Visual</strong></td>
<td>The presence of construction vehicles and machinery would impact the visual amenity of the area. The development of new structures including residential and commercial developments and road infrastructure would visually impact the community. The visual impact of vegetation removal is also considered a cumulative construction impact.</td>
<td>The proposal would not affect landscape character of the study area. The removal of vegetation would result in the removal of some visual buffers in various sections of the study area.</td>
</tr>
<tr>
<td><strong>Biodiversity</strong></td>
<td>The removal of vegetation would occur across the various projects Pinch Point projects as shown in Figure 6-46. Tree removal relative to the proposal is discussed in section 6.1.3 of this REF.</td>
<td>Vegetation removal would result in some habitat loss for local fauna. The impact of vegetation removal from the proposal are considered to be minor due to the current condition of the habitat, and as such, would not contribute to a cumulative impact of vegetation removal associated with other projects in the locality.</td>
</tr>
</tbody>
</table>
6.9.5 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative construction impacts</td>
<td>The Contractor’s Environmental Management Plan will be revised as required to consider potential cumulative impacts from surrounding development activities as they become known.</td>
<td>Construction contractor</td>
<td>Pre-construction and Construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>

6.10 Other impacts

6.10.1 Existing environment and potential impacts

<table>
<thead>
<tr>
<th>Environmental factor</th>
<th>Existing environment</th>
<th>Potential impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air quality</td>
<td>The OEH operates a network of air quality monitoring stations at various locations around the state. The closest, most representative station to the proposal is located at Oyster Bay (Green Point Road) AWS (066204), three kilometres north of the proposal. As there is insufficient data from this station, Lucas Heights ANSTO (066078) weather station has been used in this desktop study a nearby alternative, seven kilometres away (Bureau of Meteorology 2014). Air quality parameters recorded include PM10, ozone, nitrogen, sulfur dioxide and carbon monoxide. The Air quality index (AQI) for Sydney indicates data readings at the ‘good’ level (OEH 2015). The BoM Lucas Heights weather station reports on local average annual rainfall. Average annual rainfall in Lucas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Construction Potential construction impacts include minor emissions from construction plant and machinery and dust. Potential for dust from various activities would include: Clearing of vegetation and topsoil by bulldozers and/or backhoes Emissions from plant/equipment Excavation and levelling of soil by bulldozers, backhoes and/or excavators Movement of soil and fill by dump trucks Wind erosion from unsealed surfaces and stockpiles Stripping, stockpiling and managing topsoil Road sub-grade preparation. These impacts would be minor in the short term. Operation The widening of the Princes Highway would increase its carrying capacity and ease congestion. The</td>
<td></td>
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<tr>
<td>Environmental factor</td>
<td>Existing environment</td>
<td>Potential impacts</td>
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<td></td>
<td>Heights is between the years 1958 and 2017 is 1022.3 millimetres and the average annual number of cloudy days is 136.3 days (Bureau of Meteorology 2014). The average maximum temperature for Lucas Heights is 21.4 degrees Celsius, and average minimum temperature is 12.3 degrees Celsius (Bureau of Meteorology 2014). Air pollutants can be dispersed and transported by local wind patterns. The Lucas Heights weather station indicates that mean 9am wind speed ranges from 7.3 kilometres per hour in April to 9.8 kilometres per hour in October (Bureau of Meteorology 2014).</td>
<td>Proposal also includes additional slip roads which would improve through flow movements. Emissions from increased vehicles is expected, however the reduction of stop start movements and increase in traffic flow would reduce congested conditions and air emissions in the immediate vicinity as a result. The use of the study area by pedestrians and cyclists would be encouraged through improved crossings. An upgraded service road on the north bound side of the Princes Highway would also potentially encourage less polluting methods of transportation.</td>
</tr>
<tr>
<td>Aboriginal Heritage</td>
<td>An assessment of Aboriginal heritage was undertaken using the Aboriginal Heritage Management Systems Register (AHIMS). AHIMS searches were conducted on 23 November 2016 (proposal area) and 28 February 2017 (compound sites) using a 50 metre buffer of the proposal area and 200 metre buffer of both compound sites (AHIMS reports are included in Appendix G). The searches did not identify any sites within or near the study area. PACHCI clearance letters are provided in Appendix G.</td>
<td>Aboriginal sites are not likely to be uncovered during construction due to the previous disturbance from the construction of the highway. The proposal is unlikely to harm or damage any Aboriginal heritage areas as those that previously existed near to the study area have been destroyed by vandalism and former land uses.</td>
</tr>
<tr>
<td>Water Quality</td>
<td>The study area is located just within the southern border of the Georges River Basin boundary. Various large water bodies are</td>
<td>There is existing pavement drainage on both the north and south sides of the Princes Highway. This pavement</td>
</tr>
<tr>
<td>Environmental factor</td>
<td>Existing environment</td>
<td>Potential impacts</td>
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<td></td>
<td>present throughout the Sutherland Shire LGA and are relative distances away from the study area. These include:</td>
<td>drainage consists of pits, pipes and kerb gutters (refer to Figure 2-9). The proposal would potentially impact water quality during rainfall events through erosion and sedimentation processes across construction sites at sites of earthworks. Runoff across exposed areas is likely to contain sediments and nutrients from construction activities and may mobilise into drainage systems. Management and mitigation measures suitable to control erosion and sedimentation (refer to Section 6.2.4) would be established and marinated for the duration of construction to ameliorate potential impacts to downstream water quality.</td>
</tr>
<tr>
<td></td>
<td>- Bate Bay and the wider South Pacific Ocean, about eight kilometres east</td>
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<tr>
<td></td>
<td>- Woronora River, about two kilometres west</td>
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<td></td>
<td>- Hacking River, about three kilometres south</td>
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<tr>
<td></td>
<td>- Georges River, about 2.5 kilometres north.</td>
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<tr>
<td></td>
<td>Oyster Gully is a fragmented tributary that flows into the Georges River. It is located north of the proposal (around 460 metres) and is separated from the proposal by residential properties and roads.</td>
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<tr>
<td></td>
<td>Yowie Gully is located to the south east of the proposal and flows into Port Hacking. The tributary is around 430 metres from the Sylvania Road/Kingsway compound site. It is separated from the compound site by various properties and the railway corridor.</td>
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</tr>
<tr>
<td></td>
<td>An unnamed tributary that flows into the Georges River is around 780 metres north east of The Boulevard/Wandella Road compound site.</td>
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</tbody>
</table>
### 6.10.2 Safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
</table>
| Air quality - general          | An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to:  
  - potential sources of air pollution  
  - air quality management objectives consistent with any relevant published EPA and/or OEH guidelines  
  - mitigation and suppression measures to be implemented  
  - methods to manage work during strong winds or other adverse weather conditions  
  - a progressive rehabilitation strategy for exposed surfaces. | Contractor     | Detailed design / pre-construction       | Section 4.4 of QA G36 Environment Protection          |
<p>| Air quality – pollution and dust during construction | Measures (including watering or covering exposed areas) are to be used to minimise or prevent air pollution and dust. | Contractor     | Construction                | Core standard safeguard A1                             |
| Air quality – dust and air borne particulates | Works (including the spraying of paint and other materials) are not to be carried out during strong winds or in weather conditions where high levels of dust or air borne particulates are likely. | Contractor     | Construction                | Core standard safeguard A2                             |
| Air quality – vegetation removal | Vegetation or other materials are not to be burnt on site. | Contractor     | Construction                | Core standard safeguard A3                             |</p>
<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air quality – vehicles transporting waste or materials</td>
<td>Vehicles transporting waste or other materials that may produce odours or dust are to be covered during transportation.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard A4</td>
</tr>
<tr>
<td>Air quality – stockpile management</td>
<td>Stockpiles or areas that may generate dust are to be managed to suppress dust emissions in accordance with the Roads and Maritime Services Stockpile Site Management Guideline (EMS-TG-10)</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard A5</td>
</tr>
<tr>
<td>Aboriginal heritage – general</td>
<td>If Aboriginal heritage items are uncovered during the works, all works in the vicinity of the find must cease and the Roads and Maritime Services Aboriginal cultural heritage officer and regional environment manager contacted immediately. Steps in the Roads and Maritime Services Standard Management Procedure: Unexpected Heritage Items must be followed.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard B1</td>
</tr>
<tr>
<td>Water quality – dirty water</td>
<td>There is to be no release of dirty water into drainage lines and/or waterways.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard W1</td>
</tr>
<tr>
<td>Water quality – pollutants</td>
<td>Water quality control measures are to be used to prevent any materials (e.g. concrete, grout, sediment etc) entering drain inlets or waterways.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard W3</td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
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</tr>
<tr>
<td>Water quality - pollutants and spills</td>
<td>Measures to control pollutants from stormwater and spills would be investigated and incorporated in the pavement drainage system at locations where it discharges to the receiving drainage lines. Measures aimed at reducing flow rates during rain events and potential scour would also be incorporated in the design of the pavement drainage system.</td>
<td>Roads and Maritime</td>
<td>Detailed design</td>
<td>Core standard safeguard W4</td>
</tr>
<tr>
<td>Water quality – construction wash down</td>
<td>Potable water is used for wash down.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard W5</td>
</tr>
<tr>
<td>Water quality – construction wash down</td>
<td>Excess debris from cleaning and washing is removed using hand tools.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard W6</td>
</tr>
<tr>
<td>Water quality – construction wash down</td>
<td>Containment material is used to capture / filter water used in wash down.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard W7</td>
</tr>
<tr>
<td>Management of contaminated waste</td>
<td>Additional assessment is to be undertaken for soils requiring offsite disposal to ensure the correct waste classification is determined. Excavated material that is not suitable for on-site reuse or recycling, such as contaminated material should be transported to a site legally able to accept that material. If groundwater is encountered during construction, it would</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
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<tr>
<td></td>
<td>be managed and disposed of in accordance with legislation.</td>
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</tbody>
</table>
7 Environmental management

This chapter describes how the proposal will be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the potential impacts is provided. A summary of site-specific environmental safeguards is provided and the licence and/or approval requirements required prior to construction are also listed.

7.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Construction Environmental Management Plan (CEMP) will be prepared to describe the safeguards and management measures identified. The CEMP will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

The CEMP will be prepared prior to construction of the proposal and must be reviewed by the Roads and Maritime Environment Officer, Easing Sydney Congestion Program Office, prior to the commencement of any on-site works. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in the: QA Specification G36 – Environmental Protection (Management System), QA Specification G38 – Soil and Water Management (Soil and Water Plan), QA Specification G40 – Clearing and Grubbing, QA Specification G10 - Traffic Management.

Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF would be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures would minimise any potential adverse impacts arising from the proposed works on the surrounding environment. The safeguards and management measures are summarised in
<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
</table>
| GEN1 | General - minimise environmental impacts during construction | A CEMP will be prepared and submitted for review and endorsement of the Roads and Maritime Environment Manager prior to commencement of the activity. As a minimum, the CEMP will address the following:  
- any requirements associated with statutory approvals  
- details of how the project will implement the identified safeguards outlined in the REF  
- issue-specific environmental management plans  
- roles and responsibilities  
- communication requirements  
- induction and training requirements  
- procedures for monitoring and evaluating environmental performance, and for corrective action  
- reporting requirements and record-keeping  
- procedures for emergency and incident management  
- procedures for audit and review.  
- The endorsed CEMP will be implemented during the undertaking of the activity. | Contractor / Roads and Maritime project manager | Pre-construction / detailed design | Core standard safeguard GEN1 |
<p>| GEN2 | General - notification | All businesses, residential properties and other key stakeholders (eg schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity. | Contractor / Roads and Maritime project manager | Pre-construction | Core standard safeguard GEN2 |</p>
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<tr>
<td>GEN3</td>
<td>General – environmental awareness</td>
<td>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 &quot;toolbox&quot; style briefings. Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include: adjoining residential areas requiring particular noise management measures</td>
<td>Contractor / Roads and Maritime project manager</td>
<td>Pre-construction / detailed design</td>
<td>Core standard safeguard GEN3</td>
</tr>
<tr>
<td>T1</td>
<td>Property access during construction</td>
<td>Where possible, current traffic movements and property accesses are to be maintained during the works. Any disturbance is to be minimised to prevent unnecessary traffic delays and businesses/ residences informed.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard T1</td>
</tr>
<tr>
<td>T2</td>
<td>Construction traffic impacts</td>
<td>A construction Traffic Management Plan (TMP) would be prepared and implemented by the Construction Contractor, included in the Construction Environmental Management Plan (CEMP). The construction TMP would be the primary management tool to manage potential traffic and pedestrian impacts associated with construction. The construction TMP, at a minimum, would include: Outline of the road closures and alternatives</td>
<td>Construction contractor</td>
<td>Prior to construction</td>
<td>Additional safeguard</td>
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|     |        | Pedestrian and cycle provisions throughout the construction period  
 outline of the consultation process to inform the community of any road, pedestrian or cycle changes |               |        |                                |
| T3  | Access during construction | Safe pedestrian access around the work site would be provided by the construction contractor and captured within the traffic management plan  
 the parking of light construction vehicles (eg staff vehicles) would be restricted to designated areas |               |        | Additional safeguard |
| VIS1 | Visual amenity | Landscaping is to be managed in accordance with the Roads and Maritime Services Landscape guideline, 2008. | Contractor | Construction/ Post construction | Additional standard safeguard V2 |
| VIS2 | Visual amenity | Works to be carried out in accordance with EIA-N04 Guideline for Landscape Character and visual impact assessment and mitigation measures proposed in the technical paper in Appendix F. | Contractor | Construction/ Post construction | Additional standard safeguard V5 |
| AQ1 | Air quality | An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to:  
 potential sources of air pollution | Contractor | Detailed design / pre-construction | Section 4.4 of QA G36 Environment Protection |
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<td>• air quality management objectives consistent with any relevant published EPA and/or OEH guidelines</td>
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<td>• mitigation and suppression measures to be implemented</td>
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<td>• methods to manage work during strong winds or other adverse weather conditions</td>
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<td>• a progressive rehabilitation strategy for exposed surfaces.</td>
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<tr>
<td>AQ2</td>
<td>Air quality</td>
<td>Measures (including watering or covering exposed areas) are to be used to minimise or prevent air pollution and dust.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard A1</td>
</tr>
<tr>
<td>AQ3</td>
<td>Air quality</td>
<td>Works (including the spraying of paint and other materials) are not to be carried out during strong winds or in weather conditions where high levels of dust or air borne particulates are likely.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard A2</td>
</tr>
<tr>
<td>AQ4</td>
<td>Air quality</td>
<td>Vegetation or other materials are not to be burnt on site.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard A3</td>
</tr>
<tr>
<td>AQ5</td>
<td>Air quality</td>
<td>Vehicles and vessels transporting waste or other materials that may produce odours or dust are to be covered during transportation.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard A4</td>
</tr>
<tr>
<td>AQ6</td>
<td>Air quality</td>
<td>Stockpiles or areas that may generate dust are to be managed to suppress dust emissions in accordance with</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard A5</td>
</tr>
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<td></td>
<td></td>
<td>the Roads and Maritime Services Stockpile Site Management Guideline (EMS-TG-10)</td>
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</table>
| ES1 | Erosion & sedimentation | Erosion and sediment control measures are to be implemented and maintained to:  
- Prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets  
- Reduce water velocity and capture sediment on site  
- Minimise the amount of material transported from site to surrounding pavement surfaces  
- Divert clean water around the site (in accordance with the Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (the Blue Book)). | Contractor | Pre-construction/ Construction | Core standard safeguard E1 |
<p>| ES2 | Erosion &amp; sedimentation | Erosion and sedimentation controls are to be checked and maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request. | Contractor | Construction | Core standard safeguard E2 |
| ES3 | Erosion &amp; sedimentation | Erosion and sediment control measures are not to be removed until the works are complete and areas are stabilised. | Contractor | Construction | Core standard safeguard E3 |</p>
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<tr>
<td>ES4</td>
<td>Erosion &amp; sedimentation</td>
<td>Work areas are to be stabilised progressively during the works.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard E4</td>
</tr>
<tr>
<td>ES5</td>
<td>Erosion &amp; sedimentation</td>
<td>A progressive erosion and sediment control plan is to be prepared for the works.</td>
<td></td>
<td>Detailed design/ pre-construction</td>
<td>Core standard safeguard E5</td>
</tr>
<tr>
<td>ES6</td>
<td>Erosion &amp; sedimentation</td>
<td>The maintenance of established stockpile sites during is to be in accordance with the Roads and Maritime Services Stockpile Site Management Guideline (EMS-TG-10).</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard E6</td>
</tr>
<tr>
<td>ES7</td>
<td>Health and safety</td>
<td>Standard health and safety protocols in accordance with Work Cover and NSW Statutory Regulations should be applied during any excavation works in the vicinity of the service station.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
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</table>
| ES8 | Risk of spills and leaks       | - Vehicles and machinery should be properly maintained to minimise the risk of fuel/oil leaks. Routine inspections of all construction vehicles and equipment should be undertaken for evidence of fuel/oil leaks.  
- All fuels, chemicals and hazardous liquids should be stored within an impervious bunded area in accordance with Australian standards and EPA guidelines.  
- Any on-site refuelling would occur in a designated area with impervious surfaces | Contractor     | Construction               | Additional safeguard           |
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<td>• Vehicle wash down and/or cement truck washout is to occur in a designated bunded area and least 50 metres away from water bodies and surface water drains. • Emergency wet and dry spill kits would be kept on site at all times and all staff would be made aware of the location of the spill kit and trained in its use. • If an incident (eg spill) occurs, the Road and Maritime Environmental Incident Classification and Management Procedure is to be followed and the Roads and Maritime Services Contract Manager notified as soon as practicable.</td>
</tr>
<tr>
<td>ES9</td>
<td>Soil contamination</td>
<td>In the event that indications of contamination are encountered (known and unexpected, such as odorous or visually contaminated materials), work in the area would cease until an contamination assessment can be prepared to advise on the need for remediation or other action, as deemed appropriate.</td>
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<td></td>
<td>Contractor</td>
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<tr>
<td>X1</td>
<td>Potential or actual acid sulphate soils</td>
<td>Potential or actual acid sulphate soils are to be managed in accordance with the Roads and Maritime Services Guidelines for the Management of Acid SulphateMaterials 2005.</td>
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<td>Contractor</td>
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<tr>
<td>BIO1</td>
<td>Biodiversity</td>
<td>Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.</td>
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<td>Contractor</td>
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<tr>
<td>BIO2</td>
<td>Noise, light and vibration</td>
<td>Shading and artificial light impacts will be minimised through detailed design.</td>
</tr>
<tr>
<td>BIO3</td>
<td>Tree protection</td>
<td>Tree protection around retained trees will be implemented in accordance with <em>Australian Standard 4970-2009 Protection of trees on development sites.</em></td>
</tr>
<tr>
<td>BIO4</td>
<td>Tree removal and re-planting</td>
<td>A landscaping plan will be developed in consultation with Sutherland Shire Council prior to Construction and will include detail on the planting species mix and consideration of translocation of tree saplings.</td>
</tr>
<tr>
<td>BIO5</td>
<td>Tree removal</td>
<td>Native vegetation removal will be minimised through detailed design.</td>
</tr>
<tr>
<td>BIO6</td>
<td>Tree removal</td>
<td>Pre-clearing surveys will be undertaken in accordance with Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RMS projects (RTA 2011).</td>
</tr>
<tr>
<td>BIO7</td>
<td>Tree removal</td>
<td>Vegetation removal will be undertaken in accordance with Guide 4: Clearing of vegetation and removal of bushrock of</td>
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<tr>
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<td></td>
<td>the Biodiversity Guidelines: Protecting and managing biodiversity on RMS projects (RTA 2011).</td>
</tr>
<tr>
<td>BIO8</td>
<td>Tree removal</td>
<td>Native vegetation will be re-established in accordance with Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RMS projects (RTA 2011).</td>
</tr>
<tr>
<td>NIO9</td>
<td>Biodiversity Management during construction</td>
<td>Develop a Biodiversity Management Plan prior to construction to be prepared and implemented as part of the CEMP. It will proved specific guidance on measures and controls to be implemented to avoid and mitigate impact to Biodiversity during construction</td>
</tr>
<tr>
<td>NV1</td>
<td>Noise and vibration impacts to sensitive receivers day and night works</td>
<td>Works to be carried out during normal work hours (i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays). Any work that is performed outside normal work hours or on Sundays or public holidays is to minimise noise impacts.</td>
</tr>
<tr>
<td>NV2</td>
<td>Noise and vibration impacts to</td>
<td>Noise impacts are to be minimised in accordance with the Roads and Maritime Services Construction Noise and Vibration Guidelines 2016</td>
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<td>sensitive receivers</td>
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<td>NV3</td>
<td>Vibration impacts to properties adjacent to the construction works</td>
<td>Measures, including allowing adequate distance that rollers can come to adjacent buildings and/or using non vibrating rollers, are to be used to minimise or prevent vibration impacts</td>
</tr>
<tr>
<td>NV4</td>
<td>Noise and vibration at site compound</td>
<td>• Consider construction compound layout so that primary noise sources are at a maximum distance from sensitive receivers (primarily residential receivers), with solid structures (sheds and containers) placed between sensitive receivers and noise sources (and as close to the noise sources as is practical).&lt;br&gt;• Locate compressors, generators, pumps and any other fixed plant as far from residences as possible and behind site structures&lt;br&gt;• Vehicle delivery times will be scheduled where feasible to the recommended construction hours to minimise noise impacts from heavy vehicle movements and deliveries.</td>
</tr>
<tr>
<td>NV5</td>
<td>Noise management and mitigation – Source</td>
<td>Source control recutions (3-10 dB reduction) will be considered through implementation of the following:&lt;br&gt;• Using noise source controls, such as the use of residential class mufflers, to reduce noise from all plant</td>
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|     | controls (3-10 dB reduction) | and equipment including skid steers, cranes, graders, excavators and trucks.  
• Limiting the number of plant and equipment on site.  
• Avoiding using noisy plant simultaneously and/or close together, adjacent to sensitive receivers.  
• Using lower powered or reduced size equipment where noise benefits are available, where practical.  
• Design compound / ancillary / stockpile facilities such that vehicle access in a forward direction is preferred, to minimise use of reversing alarms, where feasible and reasonable.  
• Using spotters and broadband reversing alarms in place of traditional beeper reversing alarms, where practical and feasible.  
• Operating machinery in a manner which reduces maximum noise level events including excavators and dozers.  
• Ensuring plant and equipment is well maintained and not generating excessive noise.  
• Avoiding the use of horns and alarms, especially at night.  
• Turning off machinery when not in use.  
• Avoid dropping materials and tools or dragging materials across hard surfaces. | Contractor | Construction | Additional safeguard |
| NV6 | Noise management and mitigation – Path controls | Path controls (3-10 dB reduction) reductions will be considered through implementation of the following:  
• Maximising the offset distance between noisy plant items and sensitive receivers. | Contractor | Construction | Additional safeguard |
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<tr>
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<td>(3-10 dB reduction)</td>
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|     |        | • Allow adequate distance that rollers can come to adjacent buildings and/or using non vibrating rollers.  
• Orienting equipment away from sensitive receivers.  
• Using items to screen mobile plant and equipment.  
• Arrange site accesses to minimise impacts on sensitive receivers.  
• Carrying out loading and unloading away from sensitive receivers.  
Selecting site access points and roads as far as possible away from sensitive receivers. |                |          |                                 |
| NV7 | Additional noise mitigation measures (refer to Section 6.4.6) | Where exceedances are still expected to occur after standard mitigation measures (refer to 6.4.5) have been applied, the Construction Noise and Vibration Guideline (Roads and Maritime 2016) recommends the implementation of additional mitigation measures. These mitigation measures are presented in Table 6-33. Specific definitions for the terms used are presented in the guideline. | Contractor      | Construction | Additional safeguard             |
| NV8 | Construction vibration impacts to human comfort and buildings | • Preparation and implementation of a Construction Noise and Vibration Management Plan (CNVMP) for the proposal to identify detailed assessment methods for high risk works, identify receivers, complaints handling and consultation protocols.  
• Increase separation distance between vibration source and sensitive receiver where feasible and reasonable.  
• Substitution of methods of high vibration emission to lower vibration methods. | Contractor      | Construction | Additional safeguard             |
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|     |                             | • Vibration monitoring as required, to validate predictions and as part of vibration impact management including:  
|     |                             | • Undertaking trial measurements to establish the site specific vibration propagation from high risk activities to establish site specific offset distances required for compliance with the cosmetic building damage criteria.  
|     |                             | • Alternatives to high vibration source plant and equipment should be used where reasonable and feasible.  
|     |                             | • Vibration monitoring as required, as part of vibration impact management.  
|     |                             | • Where vibration monitoring is undertaken and criteria exceedances are identified, management measures should be implemented immediately to ensure vibration compliance is achieved.                                                                                                                                                                                                                                                                                                                                                   | Contractor     | Construction       | Core standard safeguard B1   |
| AH1 | Aboriginal heritage        | If Aboriginal heritage items are uncovered during the works, all works in the vicinity of the find must cease and the Roads and Maritime Services Aboriginal cultural heritage officer and regional environment manager contacted immediately. Steps in the Roads and Maritime Services Standard Management Procedure: Unexpected Heritage Items must be followed.                                                                                                                                                                                                                               | Contractor     | Construction       | Core standard safeguard B1   |
| H1  | Non-Aboriginal heritage    | A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be                                                                                                                                                                                                                                                                                                                                                      | Contractor     | Detailed design / pre-construction | Core standard safeguard H1  
Section 4.10 of QA G36      |
<p>| No. | Impact               | Environmental safeguards                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Responsibility | Timing                      | Standard / additional safeguard                  |
|-----|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                      | implemented to avoid and mitigate impacts to Non-Aboriginal heritage.                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |                             | Environment Protection                             |
| H2  | Non-Aboriginal heritage | The <em>Standard Management Procedure - Unexpected Heritage Items</em> (Roads and Maritime, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.                                                                                                                                                                                                 | Contractor    | Detailed design / pre-construction | Core standard safeguard H2 Section 4.10 of QA G36 Environment Protection |
| H3  | Heritage trees       | During roadworks and where removal of trees is unavoidable, the remaining trees are to be protected from potential harm by advice from a suitably qualified arborist. The arborist is to provide management guidelines for the protection of roots, trunks and branches.                                                                                                         | Arborist      | Construction                | Additional safeguard                              |
| H4  | Heritage trees       | Where trees are slated for relocation or total removal, a Photographic Archival Recording (PAR) should be prepared prior to all works. The report must consist of an archival standard photographic record of the site, noting the location and details of the trees to be removed as well as demonstrating the overall setting within the streetscape.                                                                                                                                              |               | Pre-construction            | Additional safeguard                              |</p>
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<tr>
<td>WQ1</td>
<td>Water quality – dirty water</td>
<td>There is to be no release of dirty water into drainage lines and/or waterways.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard W1</td>
</tr>
<tr>
<td>WQ2</td>
<td>Water quality – pollutants</td>
<td>Water quality control measures are to be used to prevent any materials (eg. concrete, grout, sediment etc) entering drain inlets or waterways.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard W3</td>
</tr>
<tr>
<td>WQ3</td>
<td>Water quality - pollutants and spills</td>
<td>Measures to control pollutants from stormwater and spills would be investigated and incorporated in the pavement drainage system at locations where it discharges to the receiving drainage lines. Measures aimed at reducing flow rates during rain events and potential scour would also be incorporated in the design of the pavement drainage system.</td>
<td>Roads and Maritime</td>
<td>Detailed design</td>
<td>Core standard safeguard W4</td>
</tr>
<tr>
<td>WQ4</td>
<td>Water quality – construction wash down</td>
<td>Potable water is used for wash down.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard W5</td>
</tr>
<tr>
<td>WQ5</td>
<td>Water quality – construction wash down</td>
<td>Excess debris from cleaning and washing is removed using hand tools.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard W6</td>
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<tr>
<td>WQ6</td>
<td>Water quality – construction wash down</td>
<td>Containment material is used to capture / filter water used in wash down.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard W7</td>
</tr>
<tr>
<td>WQ7</td>
<td>Management of contaminated waste</td>
<td>Additional assessment is to be undertaken for soils requiring offsite disposal to ensure the correct waste classification is determined. Excavated material that is not suitable for on-site reuse or recycling, such as contaminated material should be transported to a site legally able to accept that material. If groundwater is encountered during construction, it would be managed and disposed of in accordance with legislation.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>SE1</td>
<td>Socio-economic</td>
<td>A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum): Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions contact name and number for complaints. The CP will be prepared in accordance with the Community Involvement and Communications Resource Manual (RTA, 2008).</td>
<td>Contractor</td>
<td>Detailed design / pre-construction</td>
<td>Core standard safeguard SE1</td>
</tr>
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<td>No.</td>
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<tr>
<td>SE2</td>
<td>Construction related disruption</td>
<td>Access to residences and businesses would be maintained during construction. Where temporary changes to access arrangements are necessary, the contractor would advise owners and tenants and consult with them in advance with regard to alternative access arrangements.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>SE3</td>
<td>Construction related disruption</td>
<td>Affected residents and businesses would be notified of the progress of the works and advised in advance (e.g. by letterbox drop, meetings with individuals) of any anticipated changes in noise emissions or access arrangements prior to each construction stage.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>
| WR1 | Waste management               | A Resource and Waste Management Plan will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to support minimising the amount of waste produced and appropriately handle and dispose of unavoidable waste.  
The RWMP will be prepared taking into account the Environmental Procedure – Management of Wastes on Roads and Maritime Services Land and relevant Roads and Maritime Waste Fact Sheets. | Contractor     | Pre-construction/ Construction | Core standard safeguard  
Section 4.2 of QA G36 Environment Protection |
<p>| WR2 | Waste management               | Hierarchy of waste management would be implemented via:                                                                                                                                                                      | Contractor     | Construction                | Additional safeguard                                    |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• Separation of general wastes, recyclable/reusable materials, and hazardous wastes to avoid mixing with other materials/wastes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Regular housekeeping and servicing of waste storages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• General waste and recycling receptacles will be provided on site</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Waste would be transported to an appropriately licensed waste disposal and/or recycling facility</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>• Wastes (including green wastes) would not be burnt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Weed removal activities including removal of weeds prior to tree removal works to allow non-weed infested mulched material to be reused on site.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WR3</td>
<td>Waste material left on site</td>
<td>Waste material, other than vegetation and tree mulch, is not to be left on site once the works have been completed.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard M7</td>
</tr>
<tr>
<td>WR4</td>
<td>Maintenance of working areas</td>
<td>Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working day.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard M8</td>
</tr>
<tr>
<td>WR5</td>
<td>Material resourcing</td>
<td>Procurement will endeavour to use materials and products with a recycled content where that material or product is cost and performance effective.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>WR6</td>
<td>Material resourcing</td>
<td>As far as practicable, construction materials would be sourced within the Sydney region so as to reduce transport costs, including fuel usage.</td>
<td>Contractor</td>
<td>Pre-construction/ Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
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</tr>
<tr>
<td>WR7</td>
<td>Waste management and disposal</td>
<td>Suitable waste disposal locations would be identified and used to dispose of litter and other wastes on-site. Suitable containers would be provided for waste collection.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>
### 7.2 Licensing and approvals

Table 7-2 lists key legislation that are relevant to road projects and a brief explanation why a permit or licence would or would not be required.

#### Table 7-2 Summary of licensing and approvals required

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Requirement</th>
<th>Timing</th>
</tr>
</thead>
</table>
| Protection of the Environment Operations Act 1997 (s43)                   | An environment protection licence (EPL) is not required for the proposal because:  
  - The proposal involves the widening of a main road which is not a freeway or tollway, less than three kilometres in length in a metropolitan area  
  - The proposal does not involve the extraction of more than 30,000 tonnes per year of extractive materials.                                      | Not required |
| Fisheries Management Act 1994 (s199)                                      | Adequate stormwater quality measures would be implemented during the construction and operation of the proposal. The proposal would not affect any listed threatened species, populations, ecological communities, or marine vegetation or involve dredging or dam works. | Not required |
| Heritage Act 1977                                                         | The proposal would not impact on any heritage items or places listed on the State Heritage Register.                                                                                                          | Not required |
| National Parks and Wildlife Act 1974 (s90)                                | The proposal is unlikely to impact on any items or places of Aboriginal significance.                                                                                                                     | Not required |
| Threatened Species Conservation Act 1995 (s91)                            | The proposal would not have an impact on any threatened flora or fauna species, populations or communities or their habitats.                                                                                  | Not required |
| Roads Act 1993                                                            | A Road Occupancy Licence would be required from the relevant roads authority by the Contractor for road works and any temporary road closures.                                                             | Construction |
8 Conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

8.1 Justification

The Princes Highway in Kirrawee is an important arterial road which connects Sydney with Wollongong. The highway includes various intersections that connect local roads with the corridor.

The Princes Highway has become congested and demonstrates poor traffic flow capacity. Particular sections across the highway have been identified to contribute to congestion during peak periods when operating at capacity. The section of the Princes Highway considered by this proposal carries about 60,000 to 70,000 vehicles per day with heavy through movements at the Acacia Road and Oak Road intersections and a heavy right turn from the Princes Highway into Kingsway.

The proposal has been developed to achieve the following objectives:

- Improve the operational efficiency of the Princes Highway corridor, specifically the Acacia Road, Oak Road and Kingsway intersections
- Improve traffic flow and maximise use of road space
- Improve road safety and minimise non-recurrent congestion events
- Ease traffic congestion and improve the consistency of travel times for motorists, particularly during peak hours
- Deliver a solution that compliments potential future upgrades
- To deliver a value-for-money solution.

Safeguards and mitigation measures would minimise environmental impacts of the proposal and are detailed in this REF. Impacts would be minor and would be offset by the benefits provided by the proposal.

8.1.1 Social factors

Some sensitive land uses including a proposed childcare centre, schools and nursing homes would experience increased road traffic noise due to the widening and increased traffic capacity of the Princes Highway.

The development of an upgraded continuous footpath would improve the safety of pedestrians who currently utilise the slip road as a shared vehicle and pedestrian area.
Beneficial outcomes for this REF include improved travel times and pedestrian facilities across all three intersections.

8.1.2 Biophysical factors

The proposal would have a minor impact on biodiversity through the process of tree removal across various parts of the proposal. The species to be removed do not include threatened species or form part of threatened ecological communities.

Environmental management plans specific to the proposal would minimise risks to air quality, groundwater and soils during construction. Drainage systems would be reinstalled to cater for the widened highway.

8.1.3 Economic factors

During the construction phase, some businesses may be impacted by temporary changes in access. This would be offset by the additional employment and business opportunities for the region as a result of the proposal. Economic benefits would be positive once the proposal is complete, due to improved travel times for road users, improved safety and an overall reduction in congestion.

8.2 Objects of the EP&A Act

<table>
<thead>
<tr>
<th>Object</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>5(a)(i) To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.</td>
<td>The proposal consists of upgrading three key intersections along the Princes Highway to ease congestion, improve travel times and improve connectivity for all road users. Mitigation measures have been included in this proposal in response to impacts of the proposal on the environment.</td>
</tr>
<tr>
<td>Object</td>
<td>Comment</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| 5(a)(ii) To encourage the promotion and co-ordination of the orderly economic use and development of land. | The proposal would improve traffic conditions and connectivity along the Princes Highway. The upgrade of these intersections would benefit all road users through the widening of road infrastructure, development of continuous footpaths and resurfacing of roads. The upgrade would cater for future developments including:  
• The proposed development of the ‘brick pit’ into residential apartments on the corner of Oak Road and the Princes Highway  
• The proposed development of a commercial shopping village opposite the ‘brick pit’ on Flora street |
| 5(a)(iii) To encourage the protection, provision and co-ordination of communication and utility services. | Utility and communication services affected by the proposal would be maintained and relocated as required.                                                                                           |
| 5(a)(iv) To encourage the provision of land for public purposes.       | The proposal would not result in the provision of land for public purposes.                                                                                                                                   |
| 5(a)(v) To encourage the provision and co-ordination of community services and facilities. | The proposal would encourage the community to utilise the Princes Highway and for travel including vehicular pedestrian and cyclist travel. Improved connectivity between the Princes Highway and local roads would occur as a result of the proposal. |
| 5(a)(vi) To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats. | Some clearing of native vegetation would be required as part of the proposal and is specified in Section 6.1.3.                                                                                           |
| 5(a)(vii) To encourage ecologically sustainable development.            | Ecologically sustainable development is considered in Section 8.2.                                                                                                                                             |
| 5(a)(viii) To encourage the provision and maintenance of affordable housing. | Not relevant to the project.                                                                                                                                                                                   |
### Object

<table>
<thead>
<tr>
<th>Object</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>5(b) To promote the sharing of the responsibility for environmental planning between different levels of government in the State.</td>
<td>Not relevant to the project.</td>
</tr>
<tr>
<td>5(c) To provide increased opportunity for public involvement and participation in environmental planning and assessment.</td>
<td>This REF will be placed on public display and the stakeholders and the community would be provided with the opportunity to comment on the proposal. Each submission received would be considered by Roads and Maritime and would be responded to in a Submissions Report.</td>
</tr>
</tbody>
</table>

### 8.2.1 The precautionary principle

This principle states that ‘if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation’.

Evaluation and assessment of alternative options have aimed to reduce the risk of serious and irreversible impacts on the environment (refer to Section 2.4).

A range of specialist studies were undertaken for key issues to provide accurate and impartial information to assist in the assessment of the proposal (refer to Section 5).

The detailed assessment of potential environmental impacts in the preparation of the concept design has sought to minimise impacts on the urban and natural amenity of the proposal area while maintaining engineering feasibility and safety for all road users. A number of safeguards have been proposed to minimise potential impacts (refer to Section 7.2). These safeguards would be implemented during construction and operation of the proposal. No safeguards have been postponed as a result of lack of scientific certainty.

A construction environment management plan would be prepared prior to commencing construction. This requirement would ensure that the proposed activities achieve a high-level of environmental performance. No mitigation measures or management mechanisms would be postponed as a result of a lack of information.

### 8.2.2 Intergenerational equity

The principle states that ‘the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations’.

The proposal would provide long-term benefits by reducing traffic congestion, accommodating future traffic growth and addressing the road safety issues on this...
section of Princes Highway in Kirrawee. The proposal would also benefit future
generations by ensuring that it does not give rise to long-term adverse impacts on the
environment.

Should the proposal not proceed, the principle of intergenerational equity may be
compromised, as future generations would inherit a lower level of service on this
important road (refer to Section 6.3.3). Travel times and the number of accidents along
the motorway are likely to increase as the volume of traffic increases over time.

The proposal would benefit future generations by ensuring that road safety is improved,
with this being a positive benefit to road users and the wider community.

8.2.3 Conservation of biological diversity and ecological integrity

This principle states that the ‘diversity of genes, species, populations and communities,
as well as the ecosystems and habitats to which they belong, must be maintained and
improved to ensure their survival’.

An assessment of the existing local environment has been undertaken (refer to Section
6.1) in order to identify and manage any potential impacts of the proposal on local
biodiversity. Specific design efforts have been taken to avoid and minimise impacts on
biodiversity.

8.2.4 Improved valuation, pricing and incentive mechanisms

This principle requires that ‘costs to the environment should be factored into the
economic costs of a project’.

The REF has examined the environmental consequences of the proposal and identified
management measures and safeguards for areas which have the potential to experience
adverse impacts.

Requirements imposed in terms of implementation of these mitigation measures would
result in an economic cost to Roads and Maritime. The implementation of management
measures and safeguards would increase both the capital and operating costs of the
proposal. This signifies that environmental resources have been given appropriate
valuation.

The design for the proposal has been developed with an objective of minimising
potential impacts on the surrounding environment. This indicates that the concept design
for the proposal has been developed with an environmental objective in mind.

8.3 Conclusion

The proposed upgrade of Princes Highway between Acacia Road and Kingsway in
Kirrawee is subject to assessment under Part 5 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 the TSC Act, impacts on threatened species, populations 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, including avoiding the need for private property acquisition.

The proposal as described in the REF best meets the project objectives but would still result in some impacts on heritage items of local significance, biodiversity (tree removal) and visual impacts. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also reduce congestion, improve travel reliability, support population growth and labour accessibility to key employment centres, improve road safety and improve freight efficiency. On balance the proposal is considered justified and the following conclusions are made.

**Significance of impact under NSW legislation**

The proposal would be unlikely to cause a significant impact on the environment. Therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Part 5.1 of the EP&A Act. A Species Impact Statement is not required. The proposal is subject to assessment under Part 5 of the EP&A Act. Consent from Council is not required.

**Significance of impact under Australian legislation**

The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*. A referral to the Australian Department of the Environment is not required.
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.

Amy Louis
Principal Environmental Scientist
SMEC Australia
Date: 15 May 2017

I have examined this review of environmental factors and accept it on behalf of Roads and Maritime Services.

Robin Ferdous
Project Manager – South Pinch Points
Easing Sydney's Congestion
Date: 15 May 2017
10 References

AECOM (2016) Draft Environmental Investigation - Site 4, Corner Princes Highway and Oak Road Kirrawee – Gateway to South - Easing Sydney’s Congestion.


## Terms and acronyms used in this REF

<table>
<thead>
<tr>
<th>Term / Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHIMS</td>
<td>Aboriginal Heritage Management Systems Register</td>
</tr>
<tr>
<td>AQI</td>
<td>Air Quality Index</td>
</tr>
<tr>
<td>BoM</td>
<td>Bureau of Meteorology</td>
</tr>
<tr>
<td>CBD</td>
<td>Central Business District</td>
</tr>
<tr>
<td>CEMP</td>
<td>Construction environmental management plan</td>
</tr>
<tr>
<td>DCP</td>
<td>Development Control Plan</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental impact assessment</td>
</tr>
<tr>
<td>EP&amp;A Act</td>
<td><em>Environmental Planning and Assessment Act 1979</em> (NSW). Provides the legislative framework for land use planning and development assessment in NSW</td>
</tr>
<tr>
<td>EPL</td>
<td>Environmental Protection Licence</td>
</tr>
<tr>
<td>FM Act</td>
<td><em>Fisheries Management Act 1994</em> (NSW)</td>
</tr>
<tr>
<td>Heritage Act</td>
<td><em>Heritage Act 1977</em> (NSW)</td>
</tr>
<tr>
<td>ISEPP</td>
<td>State Environmental Planning Policy (Infrastructure) 2007</td>
</tr>
<tr>
<td>LCZ</td>
<td>Landscape Character Zone</td>
</tr>
<tr>
<td>$L_{eq}$</td>
<td>Equivalent Continuous Noise Level</td>
</tr>
<tr>
<td>LGA</td>
<td>Local Government Area</td>
</tr>
<tr>
<td>LoS</td>
<td>Level of Service. A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers.</td>
</tr>
<tr>
<td>LTTMP</td>
<td>NSW Long Term Transport Master Plan</td>
</tr>
<tr>
<td>Term / Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
</tr>
<tr>
<td>NCA</td>
<td>Noise Catchment Area</td>
</tr>
<tr>
<td>NES</td>
<td>Matters of national environmental significance under the Commonwealth <em>Environment Protection and Biodiversity Conservation Act 1999</em>.</td>
</tr>
<tr>
<td>Noxious Weeds Act</td>
<td><em>Noxious Weeds Act 1993 (NSW)</em></td>
</tr>
<tr>
<td>NPW Act</td>
<td><em>National Parks and Wildlife Act 1974 (NSW)</em></td>
</tr>
<tr>
<td>OEH</td>
<td>Office of Environment and Heritage</td>
</tr>
<tr>
<td>PoEO Act</td>
<td>The <em>Protection of the Environment Operations Act 1997</em></td>
</tr>
<tr>
<td>REF</td>
<td>Review of Environmental Factors</td>
</tr>
<tr>
<td>Roads and Maritime</td>
<td>NSW Roads and Maritime Services</td>
</tr>
<tr>
<td>ROL</td>
<td>Road Occupancy Licence</td>
</tr>
<tr>
<td>State Infrastructure Strategy</td>
<td><em>The NSW State Infrastructure Strategy 2012-2032</em></td>
</tr>
<tr>
<td>State Plan</td>
<td>NSW State Plan 2021</td>
</tr>
<tr>
<td>Strategic Plan</td>
<td>Sutherland Shire Strategic Plan 2011</td>
</tr>
<tr>
<td>Sutherland Shire LEP</td>
<td>Sutherland Shire Local Environmental Plan</td>
</tr>
<tr>
<td>STIF</td>
<td>Sydney Turpentine Ironbark Forest</td>
</tr>
<tr>
<td>TMP</td>
<td>Traffic Management Plan</td>
</tr>
<tr>
<td>TSC Act</td>
<td><em>Threatened Species Conservation Act 1995 (NSW)</em></td>
</tr>
<tr>
<td>VP</td>
<td>Viewpoint</td>
</tr>
</tbody>
</table>
Appendix A

Consideration of clause 228(2) factors and matters of national environmental significance
Clause 228(2) Checklist

In addition to the requirements of the *Is an EIS required?* guideline (DUAP 1995/1996) and the *Roads and Related Facilities EIS Guideline* (DUAP 1996) as detailed in the REF, the following factors, listed in clause 228(2) of the *Environmental Planning and Assessment Regulation 2000*, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any environmental impact on a community?</td>
<td></td>
</tr>
</tbody>
</table>
Construction of the proposal would result in short-term negative impacts on the local community, as discussed in Section 6. Potential impacts include traffic and transport delays, local traffic changes, construction noise and vibration, changes to amenity and accessibility. These impacts would be managed through the implementation of safeguards outlined in Section 0.  
The proposal would have a positive benefit on the local and wider community by improving the road capacity of the Princes Highway in Kirrawee, by reducing congestion, and alleviating the identified pinch points. The proposal would also provide the local community with an upgraded shared path, which would provide improved conditions for pedestrians, cyclists and motorists using this section of the Princes Highway. | Short-term negative  
Long-term positive |
| Any transformation of a locality? |  
During construction, the proposal would have a negative impact on the Princes Highway corridor through Kirrawee through the introduction of construction activities and traffic controls.  
The proposal would result in the Princes Highway having an increased number of through lanes within the existing road reserve. It has been assessed that the proposal would result in a moderate visual impact. The proposal would also require detours and additional travel times associated with the removal of right hand turns into Oak Road and the removal of direct access between Kenneth Avenue and the Princes Highway. The transformation would be consistent with the existing infrastructure and would not change the land use.  
The proposal has sought to minimise the footprint where possible. Visual impacts of the proposal on the locality would be reduced through the implementation of safeguards and management measures outlined in Section 0. | Short-term negative  
Long-term negative |
<table>
<thead>
<tr>
<th>Factor</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>The transformation is justified by the reduction in congestion and easing of identified pinch points that would be achieved by the proposal.</td>
<td></td>
</tr>
<tr>
<td>Any environmental impact on the ecosystems of the locality?</td>
<td>Short-term and long-term negative (minor)</td>
</tr>
<tr>
<td>The proposal would involve the removal of trees within the Princes Highway Roads and Maritime road reserve. These trees have been planted in the road reserve and comprise mature native and introduced trees as well as recently planted trees. The habitat value of these trees is considered to be low due to their location within the road reserve of a busy highway. The proposal would not have any impact on threatened flora and fauna species, populations or communities of their habitats. The implementation of safeguards and management measures outlined in Section 6.1.4 would minimise biodiversity impacts.</td>
<td></td>
</tr>
<tr>
<td>Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</td>
<td>Long-term negative</td>
</tr>
<tr>
<td>During construction, there would be some temporary impacts particularly in relation to noise, traffic and access and visual amenity. There would be a reduction in the aesthetic quality of the locality as the vehicle lanes of the widened Princes Highway move closer to properties on the north bound side of the road, and when the trees within the road reserve which currently screen the highway from residential properties on the same side of the road would be removed. Safeguards and management measures outlined in Section 0 would be implemented to minimise these impacts. The proposal would provide improved capacity on the Princes Highway and improve conditions for pedestrians and cyclists through the provision of an upgraded shared path. These beneficial outcomes are considered to outweigh the loss in visual aesthetic along the north bound side of the proposal.</td>
<td></td>
</tr>
</tbody>
</table>
Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?

The proposal would not impact on any Aboriginal heritage items, places or areas.

The proposal would involve the removal of about six mature trees comprising those species listed in Table 6.12, from the cluster of trees that forms heritage item 3601. Two trees would be removed from heritage item 1509 and have been identified as Eucalyptus pilularis (Blackbutt).

The removal of pre-1943 mature trees within heritage item I3601 would impact the social, historical and aesthetic heritage values of the item. The removal of the post-1943 mature and adolescent trees would reduce the item’s aesthetic significance. It has been identified that the removal of this southern avenue of trees within heritage item I3601 would have a moderate to major impact on heritage significance.

The two pre-1943 mature trees within heritage item I1509 to be removed contribute to the aesthetic significance of the north-western boundary of the heritage item.

Impact to heritage items I3601 and I1509 would be moderate to major and minor, respectively. Both items would retain significance at the local level, therefore delisting from the LEP would not result from the proposed works. Over time, the impact of the removal of these trees would be reversible, due to the opportunity for regrowth and the planting of new trees.

| Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)? |
| Long-term negative |

The proposal involves the removal of trees from within the road reserve, comprising a mixture of mature native and introduced planted trees and recently planted trees. Safeguards and management measures outlined in Section 6.1.4 would be implemented to avoid or minimise any inadvertent impacts to flora and fauna species as a result of the proposal.

| Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? |
| Neutral |

The proposal would not endanger any species of animal, plant or other form of life.
<table>
<thead>
<tr>
<th><strong>Any long-term effects on the environment?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-term positive effects on the environment include an increased road capacity and improved intersection configurations which would alleviate pinch points and improve traffic flow through this section of the Princes Highway. The proposal would provide improved infrastructure for the local and wider community.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Any degradation of the quality of the environment?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The proposal would be constructed within the road reserve of the Princes Highway and intersecting roads. The proposal would require earthworks and the removal of trees. The safeguards and management measures in Section 0 would minimise the long-term impacts of these activities. Air quality, noise, traffic and visual impacts would result from the construction and operation phases of the proposal. These impacts would be minimised through the implementation of safeguards outlined in Section 0.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Any risk to the safety of the environment?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>There is potential for road safety to be decreased during construction due to construction to be undertaken adjacent to live traffic. There would potentially be risks associated with pedestrian and cyclist interaction with construction sites. Traffic and access management safeguards outlined in Section 6.3.4 include the preparation of a traffic management plan which would address safety risks during construction. The proposal would improve road safety during operation through the provision of additional capacity on the Princes Highway, upgrading three intersections, upgrading a shared path and crossings for pedestrians and cyclists.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Any reduction in the range of beneficial uses of the environment?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>There would be no reduction in the range of beneficial uses of the environment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Any pollution of the environment?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The proposal would result in minor short-term air pollution from plant and machinery and the generation of dust during construction. There is the potential for chemical and fuel spills to occur during construction. Pollution risks associated with the</td>
</tr>
</tbody>
</table>
construction of the proposal would be managed through the implementation of the safeguards and management measures outlined in Section 6.2.4.

<table>
<thead>
<tr>
<th>Question</th>
<th>Duration</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any environmental problems associated with the disposal of waste?</td>
<td></td>
<td>Short-term negative</td>
</tr>
<tr>
<td>The proposal would result in the generation of waste from road construction. While no environmental problems would be expected with the disposal of construction waste, the safeguards and management measures outlined in Section 6.8.3 would minimise the environmental impacts associated with waste on the proposal.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?</td>
<td></td>
<td>Neutral</td>
</tr>
<tr>
<td>The proposal would not increase demands on resources (natural or otherwise) that are, or are likely to become, in short supply.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any cumulative environmental effect with other existing or likely future activities?</td>
<td></td>
<td>Short-term negative</td>
</tr>
<tr>
<td>Construction activities undertaken for the proposal would overlap with the construction activities associated with the Deicorp residential development at Oak Road. Local residents, business owners and motorists using this section of the Princes Highway at Kirrawee would be exposed to noise, air quality, construction traffic, traffic management measures and other construction impacts associated with both projects. This proposal forms part of the Roads and Maritime Gateway to the South Pinch Points Program which aims to relieve traffic congestion and improve traffic flow on Sydney’s southern corridors. In addition to undertaking this proposal, Roads and Maritime proposes to address two pinch point locations in close proximity to the proposal and implement a clearway on the south bound side of the Old Princes Highway at Kirrawee. Collectively, these projects would have a beneficial local and wider impact by improving traffic flow, reducing travel times and improving the infrastructure available to the community.</td>
<td></td>
<td>Long-term positive</td>
</tr>
<tr>
<td>Question</td>
<td>Answer</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>There would be no impact on coastal processes and coastal hazards, including those under projected climate change conditions as a result of the proposal.</td>
<td>Nil</td>
<td></td>
</tr>
</tbody>
</table>
Matters of National Environmental Significance

Under the environmental assessment provisions of the *Environment Protection and Biodiversity Conservation Act 1999*, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of the Environment.

A referral is not required for proposed actions that may affect nationally listed threatened species, populations, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Any impact on a World Heritage property? The proposal would not have</td>
<td>Nil</td>
</tr>
<tr>
<td>any impact on a World Heritage property</td>
<td></td>
</tr>
<tr>
<td>a. Any impact on a National Heritage place? The proposal would not</td>
<td>Nil</td>
</tr>
<tr>
<td>have any impact on a National Heritage place.</td>
<td></td>
</tr>
<tr>
<td>b. Any impact on a wetland of international importance? The proposal</td>
<td>Nil</td>
</tr>
<tr>
<td>would not have any impact on a wetland of international importance.</td>
<td></td>
</tr>
<tr>
<td>c. Any impact on a listed threatened species or communities? The</td>
<td>Nil</td>
</tr>
<tr>
<td>proposal would not have any impact on listed threatened species or</td>
<td></td>
</tr>
<tr>
<td>communities.</td>
<td></td>
</tr>
<tr>
<td>d. Any impacts on listed migratory species? The proposal would not</td>
<td>Nil</td>
</tr>
<tr>
<td>have any impacts on listed migratory species.</td>
<td></td>
</tr>
<tr>
<td>e. Any impact on a Commonwealth marine area? The proposal would not</td>
<td>Nil</td>
</tr>
<tr>
<td>have any impact on a Commonwealth marine area.</td>
<td></td>
</tr>
<tr>
<td>f. Does the proposal involve a nuclear action (including uranium</td>
<td>Nil</td>
</tr>
<tr>
<td>mining)? The proposal does not involve a nuclear action.</td>
<td></td>
</tr>
<tr>
<td>Factor</td>
<td>Impact</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Additionally, any impact (direct or indirect) on Commonwealth land?</td>
<td>Nil</td>
</tr>
<tr>
<td>The proposal does not impact on Commonwealth land.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B

Statutory consultation checklists
## Statutory consultation checklists

### Council related infrastructure or services

<table>
<thead>
<tr>
<th>Issue</th>
<th>Potential impact</th>
<th>Yes / No</th>
<th>If ‘yes’ consult with</th>
<th>ISEPP clause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stormwater</td>
<td>Are the works likely to have a <em>substantial</em> impact on the stormwater management services which are provided by council?</td>
<td>No</td>
<td>Sutherland Shire Council</td>
<td>ISEPP cl.13(1)(a)</td>
</tr>
<tr>
<td>Traffic</td>
<td>Are the works likely to generate traffic to an extent that will <em>strain</em> the existing road system in a local government area?</td>
<td>No</td>
<td>Sutherland Shire Council</td>
<td>ISEPP cl.13(1)(b)</td>
</tr>
<tr>
<td>Sewerage system</td>
<td>Will the works involve connection to a council owned sewerage system? If so, will this connection have a <em>substantial</em> impact on the capacity of any part of the system?</td>
<td>No</td>
<td>Sutherland Shire Council</td>
<td>ISEPP cl.13(1)(c)</td>
</tr>
<tr>
<td>Water usage</td>
<td>Will the works involve connection to a council owned water supply system? If so, will this require the use of a <em>substantial</em> volume of water?</td>
<td>No</td>
<td>Sutherland Shire Council</td>
<td>ISEPP cl.13(1)(d)</td>
</tr>
<tr>
<td>Temporary structures</td>
<td>Will the works involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a <em>minor</em> or <em>inconsequential</em> disruption to pedestrian or vehicular flow?</td>
<td>No</td>
<td>Sutherland Shire Council</td>
<td>ISEPP cl.13(1)(e)</td>
</tr>
<tr>
<td>Road &amp; footpath excavation</td>
<td>Will the works involve more than <em>minor</em> or <em>inconsequential</em> excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?</td>
<td>Yes</td>
<td>Sutherland Shire Council</td>
<td>ISEPP cl.13(1)(f)</td>
</tr>
</tbody>
</table>
## Local heritage items

<table>
<thead>
<tr>
<th>Issue</th>
<th>Potential impact</th>
<th>Yes / No</th>
<th>If ‘yes’ consult with</th>
<th>ISEPP clause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local heritage</td>
<td>Is there a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the works? If yes, does a heritage assessment indicate that the potential impacts to the item/area are more than minor or inconsequential?</td>
<td>Yes</td>
<td>Sutherland Shire Council</td>
<td>ISEPP cl.14</td>
</tr>
</tbody>
</table>

## Flood liable land

<table>
<thead>
<tr>
<th>Issue</th>
<th>Potential impact</th>
<th>Yes / No</th>
<th>If ‘yes’ consult with</th>
<th>ISEPP clause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood liable land</td>
<td>Are the works located on flood liable land? If so, will the works change flood patterns to more than a minor extent?</td>
<td>No</td>
<td>Sutherland Shire Council</td>
<td>ISEPP cl.15</td>
</tr>
</tbody>
</table>

## Public authorities other than councils

<table>
<thead>
<tr>
<th>Issue</th>
<th>Potential impact</th>
<th>Yes / No</th>
<th>If ‘yes’ consult with</th>
<th>ISEPP clause</th>
</tr>
</thead>
<tbody>
<tr>
<td>National parks and reserves</td>
<td>Are the works adjacent to a national park or nature reserve, or other area reserved under the <em>National Parks and Wildlife Act 1974</em>?</td>
<td>No</td>
<td>Office of Environment and Heritage</td>
<td>ISEPP cl.16(2)(a)</td>
</tr>
<tr>
<td>Marine parks</td>
<td>Are the works adjacent to a declared marine park under the <em>Marine Parks Act 1997</em>?</td>
<td>No</td>
<td>Department of Planning and Environment</td>
<td>ISEPP cl.16(2)(b)</td>
</tr>
<tr>
<td>Issue</td>
<td>Potential impact</td>
<td>Yes / No</td>
<td>If ‘yes’ consult with</td>
<td>ISEPP clause</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
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<td>-----------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Aquatic reserves</td>
<td>Are the works adjacent to a declared aquatic reserve under the <em>Fisheries Management Act 1994</em>?</td>
<td>No</td>
<td>Office of Environment and Heritage</td>
<td>ISEPP cl.16(2)(c)</td>
</tr>
<tr>
<td>Sydney Harbour foreshore</td>
<td>Are the works in the Sydney Harbour Foreshore Area as defined by the <em>Sydney Harbour Foreshore Authority Act 1998</em>?</td>
<td>No</td>
<td>Department of Planning and Environment</td>
<td>ISEPP cl.16(2)(d)</td>
</tr>
<tr>
<td>Bush fire prone land</td>
<td>Are the works for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?</td>
<td>No</td>
<td>Rural Fire Service</td>
<td>ISEPP cl.16(2)(f)</td>
</tr>
</tbody>
</table>
Appendix C

Concept Design Drawings
Appendix D

Noise and Vibration Assessment
Appendix E

State of Heritage Impact Assessment
Appendix F

Landscape Character and Visual Impact Assessment
Appendix G

Procedure for Aboriginal Cultural Heritage Consultation and Investigation - clearance letters