Executive Summary

The NSW Government is planning to upgrade roads around the new Northern Beaches Hospital with work planned to be completed in time for the hospital opening. The upgrade is known as the Northern Beaches Hospital – Road Connectivity and Network Enhancement Project (the Concept Proposal) and is proposed in two stages:

- Stage 1 – Hospital Connectivity Work which would provide essential access to the Northern Beaches Hospital to facilitate opening by 2018
- Stage 2 – Network Enhancement Work which would help increase capacity of the broader road network particularly along Warringah Road.

These upgrades would provide customers with a better travel experience by car or bus, increase the capacity of the road network and improve access through the area, including for pedestrians and cyclists.

An environmental impact statement (EIS) was placed on public exhibition in October 2014 which described and assessed the Concept Proposal at a strategic concept level and provided a more detailed environmental assessment of the Stage 1 Project. The Concept and Stage 1 Project Hospital Connectivity Works was approved on 29 June 2015. Construction of Stage 1 will commence in the second half of 2015. The Stage 1 Project generally involves widening along the Naree Road and Frenchs Forest Road corridor with enhancements to intersections with Forest Way, the hospital, Wakehurst Parkway, Allambie Road and Warringah Road. More specific detail and assessment is provided on the Stage 1 Project in that EIS (Roads and Maritime, October 2014).

This EIS considers the environmental, social and economic impacts specifically of the Stage 2 Project which is directed towards broader network capacity enhancement particularly along Warringah Road. Planning approval for Stage 2 is sought under Part 5.1 (State significant infrastructure) of the Environmental Planning and Assessment Act 1979 (NSW) (EP&A Act).

Volume 1 of this EIS describes the proposal and why it is needed, assesses the impacts of the project and identifies measures that would be implemented to avoid and minimise those impacts. Volumes 2 and 3 contain the technical papers used to inform the preparation of this assessment.
What is proposed?

An overview figure showing the key features of the Stage 2 Project can be found on the next page. The Stage 2 Project would include:

- Provision of four through lanes on Warringah Road (two lanes in each direction for east-west through traffic) within a grade separated open ‘slot’ (or underpass) for about 1.3 kilometres. Ingress and egress points from and to the slot include:
  - Western extent – Warringah Road near Fitzpatrick Avenue East
  - Eastern extent – Warringah Road from about 350 metres east of the Wakehurst Parkway grade separated intersection
  - Provision of a two-lane on-ramp (merging into one lane) from Wakehurst Parkway (southbound) into the slot (westbound).

Widening of Warringah Road from west of Fitzpatrick Avenue East to west of Allambie Road to include surface level lanes for the length of the project as follows:

- Westbound travel lanes on the southern side of the Warringah Road corridor
- Eastbound travel lanes on the northern side of the Warringah Road corridor (generally using existing road pavement)
- The intersections of Warringah Road with Forest Way, Hilmer Street and Wakehurst Parkway to form a surface level bridge over the slot to provide for traffic movements at surface level and allow east-west through traffic in the slot to pass beneath uninterrupted
- Upgrades or adjustments to existing intersections of Warringah Road with Fitzpatrick Avenue East, Rodborough Road and Allambie Road
- Widening of Wakehurst Parkway from the intersection of Warringah Road to south of Aquatic Drive
- Provision of a new connection at Aquatic Drive including right in from Wakehurst Parkway (northbound), left in from Wakehurst Parkway (southbound) and left out from Aquatic Drive onto Wakehurst Parkway (southbound)
- Provision of shared (pedestrian and cyclist) bridges at the following locations:
  - Across Warringah Road west of the intersection of Forest Way (removal and replacement of the existing pedestrian bridge)
  - Across Warringah Road on the western side of the intersection with Hilmer Street (new pedestrian bridge).
- Removal of the existing pedestrian crossing across Warringah Road at Hilmer Street
- Shared paths and footpaths on sections of Warringah Road, Wakehurst Parkway, Forest Way, Aquatic Drive and Allambie Road.
What are the project objectives?

The strategic aims of the Concept Proposal relate to provision of a road network solution that optimises connectivity of the existing road network surrounding the Northern Beaches Hospital at Frenchs Forest. At a wider level, the Concept Proposal (which includes the Stage 2 Project) also aims to reinforce Warringah Road and Wakehurst Parkway as key arterial connections between the beachside suburbs of Sydney’s north, Chatswood and Sydney’s CBD.

Specific project objectives are to:

- Improve peak period travel speeds and reliability on Warringah Road following the development of the Northern Beaches Hospital and the surrounding precinct
- Improve the network performance surrounding the Northern Beaches Hospital to support the development of the precinct
- Support the activation of the Northern Beaches Hospital Precinct by facilitating access connections to the hospital
- Allow for road based public transport along and across the corridor
- Maintain or improve road safety in accordance with current standards
- Minimise impacts on the environment
- Optimise the design to provide an urban design and landscape outcome that complements the surrounding environs.
New shared path and footpaths on both sides of Warringah Road

New on-ramp from Wakehurst Parkway southbound into the slot westbound

Through traffic on Warringah Road separated from turning traffic at Wakehurst Parkway by way of an underpass

Widening of Allambie Road south of Warringah Road

Proposed shared pedestrian / cyclist bridge

New shared path east side of Wakehurst Parkway

New shared path west side of Allambie Road

New shared path east side and footpath west side of Forest Way

Widening and upgrade along Warringah Road at surface

Through traffic on Warringah Road separated from turning traffic at Forest Way by way of an underpass

Through traffic on Warringah Road separated from turning traffic at Hilmer Street by way of an underpass

New footpath north side Aquatic Drive

Connecting Aquatic Drive with Wakehurst Parkway

Remove existing pedestrian bridge and replace with shared pedestrian / cyclist bridge

Underpass for through traffic

Shared pedestrian and cycle bridge

KEY
Stage 1 Project
Stage 2 Project
Hospital Connectivity Work
Network Enhancement Work
Underpass for through traffic
Shared pedestrian and cycle bridge
Why is it needed?

The Northern Beaches Hospital site is strategically positioned both with regard to its location in the eastern half of the North Sydney Local Health District and within the Northern Beaches road transport network. However, there are existing constraints within the surrounding road network that would limit efficient access to the hospital. Removal of these constraints alone without changes to the surrounding road network is not practicable as it would exacerbate already high levels of congestion that impact on traffic movement, particularly during peak travel periods.

The NSW Government’s *Long Term Transport Master Plan* (Transport for NSW, 2012a) identifies Warringah Road as a key strategic transport corridor linking Dee Why and Chatswood. Heavy traffic flows and congestion along Warringah Road during commuter peak periods and, to a lesser degree, during business hours result in low average peak travel speeds, unreliable travel times and disruptions to traffic movements. This impacts on both road users and the adjoining community. Warringah Road is already operating at or beyond capacity during peak periods and is expected to experience continued traffic growth in the future.

As traffic volumes increase, congestion levels would also increase significantly, resulting in lower average travel speeds and an increase in the average delay per vehicle. In the evening peak period the average travel speed is predicted to reduce by up to 30 per cent between 2012 and 2018 (from 28 km/h to 20 km/h). By 2028 travel speeds are predicted to reduce by a further 16 per cent to around 17 km/h. The average delay per vehicle is predicted to increase by about 70 per cent to 2018 (from around 3.5 minutes to around six minutes) and by a further 30 per cent by 2028 (to almost eight minutes).

An analysis of the existing conditions indicates that some intersections currently operate at capacity and the predicted increase in traffic volumes would only increase the level of congestion. A considerable increase in network capacity would be required to maintain, let alone improve, existing service levels given critical intersections are currently operating at or over their effective capacity and that proposed land use changes would exacerbate these conditions.

Existing levels of congestion also affect the reliability of bus services and achievement of target operational speeds, and are expected to worsen with increased congestion. This would also constrain the introduction of bus priority initiatives within the corridor.
How would the project satisfy this need?

The Stage 2 Project would provide a further significant improvement to the operation of the road network surrounding the Northern Beaches Hospital beyond the improvements provided by the Stage 1 Project. It would provide sufficient road capacity to cater for the traffic generated by the hospital as well as background traffic growth.

Following construction of the Stage 2 Project (with the Stage 1 Project also constructed), the road network is anticipated to operate with increased average speeds and reduced average delays. In the evening peak period, traffic modelling indicates average travel speeds would be 30 per cent faster than without the project in 2018 and almost 50 per cent faster in 2028. Travel speed improvements are presented in the following figure which shows the ‘Base Case’ in 2012 (before the hospital is operational), ‘Do Minimal’ in 2018 and 2028 (with the hospital but without the Stage 2 Project) and Stage 2 Project in 2018 and 2028 (with the hospital operational and with the Stage 2 Project).
The Stage 2 Project would also significantly improve the operation of the Warringah Road corridor by separating the Warringah Road through traffic from turning surface road traffic at the intersections with Forest Way, Hilmer Street and Wakehurst Parkway. This would increase the number of intersections operating with a high level of service (LoS A-D) and decrease the number of intersections operating with a low level of service (LoS F), as shown in the following figure¹.

![Graph showing number of intersections with different levels of service]

The Stage 2 Project is anticipated to improve peak period bus travel speeds on Frenchs Forest Road due to the increased east-west capacity on Warringah Road which would attract some traffic from Frenchs Forest Road and improve the operation of the Frenchs Forest Road corridor. Other public transport improvements include lengthening the bus stop bay on Forest Way on approach to Warringah Road.

New and upgraded footpaths and shared paths (capable of accommodating pedestrians and cyclists) would also be provided on Warringah Road and parts of Wakehurst Parkway, Allambie Road, Aquatic Drive and Forest Way. Shared (pedestrian and cyclist) bridges over Warringah Road are also proposed as part of the Stage 2 Project thereby improving connectivity between residential areas, the Forestway Shopping Centre, Frenchs Forest Public School, The Forest High School and the hospital.

¹ Note: the number of intersections assessed in the 2012 and future year (2018, 2028) cases is different due to the new intersections that are created to provide access to the hospital and also the new intersection on Wakehurst Parkway at Aquatic Drive)
What alternatives were considered?

Roads and Maritime considered a number of different alternatives to the project. These included the ‘base case’ (or ‘do nothing/do minimum’) option, improving the wider regional road network, investment to improve public transport, and demand management.

In the context of the identified transport challenges, the ‘base case’ option was not seen as a viable option. The other initiatives were generally considered to complement the project but none would be an adequate standalone response to the identified strategic need.

Option identification for the Concept Proposal began with development of various minor work at primary intersections before progressing into a network wide solution, as evaluation identified that the more rudimentary options would not sufficiently alleviate congestion.

These investigations identified the need for the Stage 1 work, which were developed in response to the main hospital access being proposed on Frenchs Forest Road West, and the Stage 2 work to address the need for broader network enhancements.

Consideration of options for the Stage 2 Project included an industry review of the Stage 2 Project options (developed by Roads and Maritime) in 2013, followed by invited engineering consultancies participating in an ‘industry challenge’ process developing and testing an overpass option and four different underpass options. At the same time that the ‘industry challenge’ process commenced, a further engineering consultancy was engaged as a technical reviewer to further strengthen the robustness of the option development and evaluation process.

Following feedback from community consultation, Roads and Maritime also investigated a further three options in collaboration with Transport for NSW, Health Infrastructure and the Department of Education and Communities. These included a tunnel using two different construction methods, and an underpass with widening on the northern side of Warringah Road. The investigations included an assessment of cost and impacts on local properties, businesses, The Forest High School and the new hospital.

How did the community provide input into the development of the project?

In March and April 2014 and again in July and August 2014, various consultation activities were carried out to inform the community about the project and to encourage feedback.

These activities included:

- Community updates, with each distributed to up to 20,000 residents
- A total of 13 community information sessions have been held since April 2014 and were attended by more than 1300 people
- Meetings with industry groups, councils, chambers of commerce, clubs and affected land owners
- Ongoing meetings with The Forest High School and Health Infrastructure.

Further consultation was carried out in October and November 2014 during public exhibition of the EIS for the Concept Proposal and Stage 1 Project.
A range of other consultation activities were also adopted including door knocking, newsletters, advertisements and media announcements seeking feedback and input on the project.

Extensive community feedback was received which has informed the preparation of this EIS. Roads and Maritime will continue to provide opportunities for the community to participate in the ongoing design process and in further minimising project impacts.

What are the main beneficial outcomes expected?

The main beneficial outcomes of the Stage 2 Project would be the improvements to network performance and operational benefits in relieving congestion along the Warringah Road corridor and other key arterial roads connecting to it. This would result in increases to peak period travel speeds and improvements to intersection performance resulting in decreased delays for motorists. It would also improve bus travel times due to the less congested network. The Stage 2 Project would also provide improvements to the pedestrian and cycling network.

What are the main adverse outcomes expected?

A number of potential environmental impacts from the Stage 2 Project have been avoided or reduced during the assessment of alternatives, development of the strategic design for the Concept Proposal, and through concept design development for the Stage 2 Project. Notwithstanding, the Stage 2 Project would result in impacts during construction and operation.

During construction of the Stage 2 Project adverse impacts would include:

- Noise and vibration, including potential night time disturbance associated with out-of-hours work and potential disturbance to residents, the Forest High School and Frenchs Forest Public School
- Dust and construction plant and vehicle emissions
- Traffic and access impacts, including cumulative impacts from the concurrent construction of the Stage 1 and Stage 2 projects and hospital construction
- Impacts on an endangered ecological community (Duffys Forest) which would require offsetting
- Generation of spoil and groundwater inflow during excavation of the slot.

Construction impacts would be minimised through further consideration during detailed design and construction planning, and application of best practice management and mitigation measures including consultation with affected residents and businesses.

During operation, adverse impacts would include:

- Traffic noise requiring noise attenuation measures such as noise barriers
- Visual impacts associated with new road infrastructure and loss of vegetation
- Socio-economic impacts including changes to access, and residential and business property acquisition
- Impacts on items of historic heritage.

With regard to traffic and transportation, there would be few minor adverse impacts. These include restricted movements into Maxwell Parade (no left turn for westbound traffic in central
lanes exiting from the slot) and prohibited left turn movements from the Warringah Road surface lanes into Fitzpatrick Avenue (East). These changes are proposed for road safety purposes.

There would also be a loss of almost 40 parking spaces at the northern end of Bantry Bay Road, Hilmer Street and Fitzpatrick Avenue (East). However, the spaces would typically be lost along the frontages of properties that would be acquired as part of the Stage 2 Project (such as Bantry Bay shops) and so are likely to be commensurate with the reduction in demand from the acquired properties.

Impacts identified in this EIS can be minimised through appropriate mitigation measures or, where relevant, design refinements.

How will the likely impacts be managed?

Project development and concept design investigations have sought to avoid and minimise impacts on the local environment and community. For each key issue, the existing environment is described in the EIS, the potential impacts (both direct and indirect) of the project during construction and operation are assessed and the influence of relevant planning matters is considered. The assessment of key issues presented in this EIS is supported by detailed investigations. These are documented in the working papers of this EIS. The EIS also identifies comprehensive mitigation and management measures that would be implemented to avoid, manage, mitigate, offset and/or monitor impacts during pre-construction activities, construction and operation of the project. These include best practice construction environmental planning and management techniques, urban design and landscaping treatments, noise mitigation measures and a biodiversity offset strategy consistent with the NSW offset principles for major projects (Office of Environment and Heritage (OEH) 2013). During further detailed design and construction planning, some impacts identified within this EIS are likely to be able to be further mitigated.

The design, construction and operation of the project would be carried out in accordance with extensive environmental management commitments identified in this EIS, as well as any additional measures identified in conditions of approval for the project.
How can I comment on the proposal and/or the environmental impact statement?

The NSW Department of Planning and Environment (DP&E) will make the EIS publicly available for a minimum period of 30 days. During this period, it will be available at selected local council and Roads and Maritime offices, at various staffed displays in the region, on the DP&E website: http://majorprojects.planning.nsw.gov.au/ and on the project website: http://www.rms.nsw.gov.au/roadprojects/projects/sydney_region/northern_sydney_region/nbh/

Roads and Maritime will also be conducting community information sessions. A project information line will also be available throughout the exhibition period to answer questions from the community relating to the project: 1300 367 459.

To provide feedback on the project, a person may make written submissions to the Director of Infrastructure DP&E during the exhibition period. All submissions received will be placed on the DP&E website. Submissions should be made through the DP&E website, by fax or by mail.

Online submissions may be provided via the DP&E website at:
http://majorprojects.planning.nsw.gov.au

Fax submissions may be directed to:
(02) 9228 6366

Written submissions may also be directed to:
Director of Infrastructure
Department of Planning and Environment
GPO Box 39
Sydney NSW 2001
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Certification

Submission of environmental impact statement.
Prepared under Part 5.1 of the Environmental Planning and Assessment Act 1979 (NSW).

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Proposed development:
Northern Beaches Hospital Road Connectivity and Network Enhancements Project – Stage 2

Address of the land on which the infrastructure to which the statement relates:
The road infrastructure, the subject of the Stage 2 Project, is located within the Warringah local government area, in the following parts of Frenchs Forest: Warringah Road from west of Fitzpatrick Avenue to the west of Allambie Road; Forest Way from Warringah Road to north of Rabbett Street (Stage 1 Project tie-in); Wakehurst Parkway from intersection with Warringah Road to south of Aquatic Drive; Aquatic Drive for 150 metres from the Wakehurst Parkway intersection; and Allambie Road from Warringah Road to Rodborough Road.

Description of the infrastructure to which the statement relates:
Staged development of the Northern Beaches Hospital Road Connectivity and Network Enhancement Project, including:
- Stage 2 network enhancement works.

Environmental impact statement:
An environmental impact statement is attached addressing all matters in accordance with Part 5.1 of the Environmental Planning and Assessment Act 1979 (NSW).
Declaration:
I certify that I have prepared the contents of this environmental impact statement in response to the Secretary’s Environmental Assessment Requirements (SEARs) dated 10 September 2014 (and the supplementary SEARs dated 18 May 2015) and the relevant provisions of Schedule 2 of the Environmental Planning and Assessment Regulation 2000. To the best of my knowledge, the environmental impact statement contains all available information that is relevant to the environmental assessment of the infrastructure to which the statement relates and the information which it contains is not false or misleading.

Signature:

Name: Amy Louis Braith Gilchrist
Date: 16 July 2015 16 July 2015
### Glossary of terms and abbreviations

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid sulphate soils</td>
<td>The acidic soils that result from the disturbance or drainage and subsequent oxidation of previously waterlogged potential acid sulphate soils</td>
</tr>
<tr>
<td>Action Plan</td>
<td>NSW Northern Beaches Regional Action Plan</td>
</tr>
<tr>
<td>Acute noise levels</td>
<td>Road traffic noise levels received at private dwellings that are predicted to be greater than 65dB(A) Leq(15hr) (day) and 60dB(A) Leq(9hr) (night), as presented in Practice Note IV, Step 3, Part (2) of the Roads and Maritime Services Environmental Noise Management Manual</td>
</tr>
<tr>
<td>AEC</td>
<td>Areas of Environmental Concern</td>
</tr>
<tr>
<td>Afflux</td>
<td>An increase in water level resulting from a constriction in the flow path</td>
</tr>
<tr>
<td>AHIMS</td>
<td>Aboriginal Heritage and Information Management System</td>
</tr>
<tr>
<td>AADT</td>
<td>Annual average daily traffic</td>
</tr>
<tr>
<td></td>
<td>The total traffic in both directions at a specified location calculated from mechanically obtained axle counts</td>
</tr>
<tr>
<td>AEP</td>
<td>Annual exceedance probability</td>
</tr>
<tr>
<td></td>
<td>The probability of a rainfall or flood event exceeding a nominated level in a year. A one per cent AEP is the probability of an event exceeding a nominated level in 100 years</td>
</tr>
<tr>
<td>AQMP</td>
<td>Air Quality Management Plan</td>
</tr>
<tr>
<td>ASSMAC</td>
<td>(NSW) Acid Sulfate Soils Management Advisory Committee</td>
</tr>
<tr>
<td>AHD</td>
<td>Australian Height Datum</td>
</tr>
<tr>
<td></td>
<td>The standard reference level used to express the relative height of various features. A height given in metres AHD is essentially the height above sea level</td>
</tr>
<tr>
<td>Alignment</td>
<td>The general route (e.g. of a roadway) in plan and elevation</td>
</tr>
<tr>
<td>Alluvium</td>
<td>Unconsolidated deposit of gravel, sand or mud formed by water flowing in identifiable channels. Commonly well sorted and stratified</td>
</tr>
<tr>
<td>AM peak period</td>
<td>6am to 10am weekdays</td>
</tr>
<tr>
<td>ANZECC</td>
<td>Australian and New Zealand Environment and Conservation Council</td>
</tr>
<tr>
<td></td>
<td>A Ministerial Council operating between 1991 and 2001 that provided a forum for member governments to develop coordinated policies about national and international environment and conservation issues</td>
</tr>
<tr>
<td>Aquifer</td>
<td>Geologic formation, group of formations, or part of a formation capable of transmitting and yielding quantities of water</td>
</tr>
<tr>
<td>Archaeological site</td>
<td>A site with any material evidence of past Aboriginal activity that remains within a context or place that can be reliably related to that activity</td>
</tr>
<tr>
<td>Term</td>
<td>Meaning</td>
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</tr>
<tr>
<td>ARI</td>
<td>Average Recurrence Interval Used to describe the frequency or probability of floods occurring (e.g. a 100 year ARI flood is a flood that occurs or is exceeded on average once every 100 years)</td>
</tr>
<tr>
<td>Asphalt or asphaltic concrete</td>
<td>A dense, continuously graded mixture of coarse and fine aggregates, mineral filler and bitumen usually produced hot in a mixing plant</td>
</tr>
<tr>
<td>Background noise level</td>
<td>The ambient sound-pressure noise level in the absence of the sound under investigation exceeded for 90 per cent of the measurement period. Normally equated to the average minimum A-weighted sound pressure level</td>
</tr>
<tr>
<td>Batter</td>
<td>The side slope of walls, embankments and cuttings or the degree of such slope, usually expressed as a ratio of horizontal distance to one vertical height</td>
</tr>
<tr>
<td>Bank protection</td>
<td>Devices for reducing scour by sea or river such as mattresses, groynes, pegged down brushwood, plantings etc</td>
</tr>
<tr>
<td>BCR</td>
<td>Benefit-cost ratio (the ratio of the present value of benefits to the present value of costs of a project)</td>
</tr>
<tr>
<td>Bedrock</td>
<td>Solid rock underlying loose deposits such as soil or alluvium</td>
</tr>
<tr>
<td>Bore</td>
<td>A cylindrical drill hole sunk into the ground from which water is pumped for use or monitoring</td>
</tr>
<tr>
<td>Borehole</td>
<td>A hole produced in the ground by drilling for the investigation and assessment of soil and rock profiles</td>
</tr>
<tr>
<td>Buffer zone</td>
<td>A buffer zone occurs around the periphery of an area and provides a layer of protection for that area. The purpose of a buffer zone is to avert the effect of negative environmental or human influences, whether or not it embodies great natural or cultural value itself</td>
</tr>
<tr>
<td>Carriageway</td>
<td>The portion of a roadway devoted to vehicular traffic generally delineated by kerbs, a verge or a median</td>
</tr>
<tr>
<td>Cast in situ</td>
<td>Concrete which is cast directly into its final position</td>
</tr>
<tr>
<td>Catchment</td>
<td>The area drained by a stream or body of water, or the area of land from which runoff is collected</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>CESDF</td>
<td>Coastal Enriched Sandstone Dry Forest</td>
</tr>
<tr>
<td>Chainage</td>
<td>Any point on a control line selected to provide more detailed information about the cross-section or any other feature mentioned in the drawings. Also known as a station</td>
</tr>
<tr>
<td>Clearing</td>
<td>The removal of vegetation or other obstacles at or above ground level</td>
</tr>
<tr>
<td>CO</td>
<td>Carbon monoxide</td>
</tr>
<tr>
<td>CO₂-e</td>
<td>Carbon dioxide equivalent emissions - a metric measurement used to compare the emissions from various greenhouse gases based upon their global warming potential</td>
</tr>
<tr>
<td>Term</td>
<td>Meaning</td>
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<tr>
<td>CoC</td>
<td>Contaminant(s) of concern</td>
</tr>
<tr>
<td>Colluvial soils</td>
<td>Stony clays that have been moved downslope by soil creep and slopewash but may include a proportion of windblown red clay (parna) and higher terrace alluvium</td>
</tr>
<tr>
<td>Concentration (air quality)</td>
<td>Vehicles emit pollutants to the air, which are transported and diluted resulting in a quantity of pollutant per volume of ambient air. Ambient air quality goals are expressed in terms of concentrations, which are measured in parts per million or micrograms per cubic metre</td>
</tr>
<tr>
<td>Concept design</td>
<td>Initial functional layout of a road/road system or other infrastructure. Used to facilitate understanding of a project, establish feasibility, and provide a basis for estimating and to determine further investigations needed for detailed design</td>
</tr>
<tr>
<td>Concept Proposal</td>
<td>The Northern Beaches Hospital Road Connectivity and Network Enhancements Project (comprising Stages 1 and 2)</td>
</tr>
<tr>
<td>CSM</td>
<td>Conceptual Site Model</td>
</tr>
<tr>
<td>dBA</td>
<td>Decibels using the A-weighted scale measured according to the frequency of the human ear</td>
</tr>
<tr>
<td>DECCW (NSW)</td>
<td>Department of Environment, Climate Change and Water (former)</td>
</tr>
<tr>
<td>Decibel</td>
<td>A scale unit used in the comparison of powers and levels of sound energy</td>
</tr>
<tr>
<td>DFEC</td>
<td>Duffys Forest Ecological Community</td>
</tr>
<tr>
<td>Dioxin</td>
<td>A group of halogenated organic compounds, significant because they act as environmental pollutants</td>
</tr>
<tr>
<td>Design speed</td>
<td>A nominal speed used for the design of geometric features of the road, such as curves</td>
</tr>
<tr>
<td>DGRs</td>
<td>Requirements and specification for the environmental assessment prepared by the Director General of the (NSW) Department of Planning and Environment under the (NSW) Environmental Planning and Assessment Act 1979. From 2014, DGRs are superseded by SEARs</td>
</tr>
<tr>
<td>DP&amp;E</td>
<td>NSW Department of Planning and Environment</td>
</tr>
<tr>
<td>DP&amp;I</td>
<td>Former NSW Department of Planning and Infrastructure</td>
</tr>
<tr>
<td>Draft Metropolitan Strategy</td>
<td>Draft Metropolitan Strategy for Sydney to 2031</td>
</tr>
<tr>
<td>Edge effect</td>
<td>Edge effects refer to the changes in population or community structure that occur at the boundary of two habitats. Areas with small habitat fragments generally exhibit pronounced edge effects that may extend throughout the patch (e.g. weed invasion)</td>
</tr>
<tr>
<td>ESD</td>
<td>Ecologically Sustainable Development</td>
</tr>
<tr>
<td>Ecology</td>
<td>The relationship between living things and the environment</td>
</tr>
<tr>
<td>Ecosystem</td>
<td>A functional unit of energy transfer and nutrient cycling in a given place. It includes all relationships within the biotic community and between the biotic components of</td>
</tr>
<tr>
<td>Term</td>
<td>Meaning</td>
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</tr>
<tr>
<td>the system</td>
<td></td>
</tr>
<tr>
<td>EEC</td>
<td>Endangered ecological community. An ecological community identified by relevant legislation as having endangered status</td>
</tr>
<tr>
<td>EMP</td>
<td>Environmental management plan</td>
</tr>
<tr>
<td>Environment</td>
<td>A term for all the conditions (physical, chemical, biological and social) in which an organism or group of organisms, including humans, exists</td>
</tr>
<tr>
<td>EIS</td>
<td>Environmental impact statement</td>
</tr>
<tr>
<td></td>
<td>An environmental impact statement is a focussed analysis prepared for the purposes of Part 5.1 of the (NSW) Environmental Planning and Assessment Act 1979, written generally to comply with the requirements issued by the Secretary of the (NSW) Department of Planning and Environment</td>
</tr>
<tr>
<td>EP&amp;A Act</td>
<td>(NSW) Environmental Planning and Assessment Act 1979</td>
</tr>
<tr>
<td>EPA</td>
<td>(NSW) Environment Protection Authority</td>
</tr>
<tr>
<td>EPBC Act</td>
<td>(Commonwealth) Environment Protection and Biodiversity Conservation Act 1999</td>
</tr>
<tr>
<td>ESU</td>
<td>Ecological Sampling Unit</td>
</tr>
<tr>
<td></td>
<td>An ecological sampling unit represents a patch of vegetation in the study area with similar vegetation type and condition, and similar habitat features</td>
</tr>
<tr>
<td>Evening peak</td>
<td>3pm to 6 pm weekdays</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse gas</td>
</tr>
<tr>
<td>Grade separation</td>
<td>The separation of road, rail or other traffic so that crossing movements, that would otherwise conflict, are at different levels</td>
</tr>
<tr>
<td>Groundwater</td>
<td>Subsurface water contained within the saturated zone</td>
</tr>
<tr>
<td>Haul road</td>
<td>A designated road, often temporary, used for moving materials (often used when new infrastructure is being constructed)</td>
</tr>
<tr>
<td>HI</td>
<td>(NSW) Health Infrastructure</td>
</tr>
<tr>
<td>Hydrocarbon</td>
<td>Any organic compound – gaseous, liquid or solid – consisting only of carbon and hydrogen</td>
</tr>
<tr>
<td>Hydrology</td>
<td>The study of rainfall and surface water runoff processes</td>
</tr>
<tr>
<td>ICNG</td>
<td>Interim Construction Noise Guideline</td>
</tr>
<tr>
<td>Infrastructure SEPP</td>
<td>Infrastructure State Environmental Planning Policy</td>
</tr>
<tr>
<td>Interchange</td>
<td>A grade separation of two or more roads with one or more interconnecting carriageways</td>
</tr>
<tr>
<td>KTP</td>
<td>Key threatening process</td>
</tr>
<tr>
<td></td>
<td>A threat can be listed under the Threatened Species Conservation Act 1995 as a ‘key threatening process’ if it adversely affects threatened species, populations or ecological communities or if it could cause species, populations or ecological communities that are not threatened to become threatened</td>
</tr>
<tr>
<td>Term</td>
<td>Meaning</td>
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<tr>
<td>LA10</td>
<td>The noise level that is exceeded for 10% of the sample period. During the sample period, the noise level is below the LA10 level for 90% of the time. The LA10 is a common noise descriptor for environmental noise and road traffic noise</td>
</tr>
<tr>
<td>LA90</td>
<td>The noise level that is exceeded for 90% of the sample period. During the sample period, the noise level is below the LA90 level for 10% of the time. This measure is commonly referred to as the background noise level</td>
</tr>
<tr>
<td>LA_{eq}</td>
<td>The equivalent continuous sound level. This is the energy average of the varying noise over the sample period and is equivalent to the level of constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise</td>
</tr>
<tr>
<td>Landscape character</td>
<td>The aggregate of built, natural and cultural aspects that make up an area and provide a sense of place. Includes all aspects of a tract of land – built, planted and natural topographical and ecological features</td>
</tr>
<tr>
<td>LCZ</td>
<td>Landscape Character Zone</td>
</tr>
<tr>
<td>LED</td>
<td>Light emitting diode</td>
</tr>
<tr>
<td>LEP</td>
<td>Local Environmental Plan</td>
</tr>
<tr>
<td>LGA</td>
<td>Local Government Area</td>
</tr>
<tr>
<td>Local road</td>
<td>A road or street used primarily for access to abutting properties under the care of Council or similar</td>
</tr>
<tr>
<td>Longitudinal section</td>
<td>The section drawn along the length of the route showing vertical elevation</td>
</tr>
<tr>
<td>LoS</td>
<td>Level of service</td>
</tr>
<tr>
<td></td>
<td>A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers</td>
</tr>
<tr>
<td>Lot</td>
<td>A parcel of land defined by measurement as a lot in a deposited plan (DP) or as a Crown portion or allotment</td>
</tr>
<tr>
<td>LTTPM</td>
<td>NSW Long Term Transport Master Plan</td>
</tr>
<tr>
<td>MLALC</td>
<td>Metropolitan Local Aboriginal Land Council</td>
</tr>
<tr>
<td>NBH</td>
<td>Northern Beaches Hospital</td>
</tr>
<tr>
<td>NCA</td>
<td>Noise catchment area</td>
</tr>
<tr>
<td>NGA</td>
<td>National Greenhouse Accounts</td>
</tr>
<tr>
<td>NOx</td>
<td>Oxides of nitrogen</td>
</tr>
<tr>
<td>NOW</td>
<td>NSW Office of Water</td>
</tr>
<tr>
<td>NSW 2021</td>
<td>NSW 2021: A plan to make NSW number one</td>
</tr>
<tr>
<td>OEH</td>
<td>(NSW) Office of Environment and Heritage.</td>
</tr>
<tr>
<td>Term</td>
<td>Meaning</td>
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<tr>
<td>PACHCI</td>
<td>Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation</td>
</tr>
<tr>
<td>PAD</td>
<td>Potential archaeological deposit – any location considered to have a moderate to high potential for subsurface archaeological material</td>
</tr>
<tr>
<td>pH</td>
<td>A measure of acidity or alkalinity of a solution, numerically equal to seven for neutral solution, increasing with increasing alkalinity and decreasing with increasing acidity. Originally stood for the words potential of hydrogen</td>
</tr>
<tr>
<td>Piling – bored</td>
<td>A method of inserting piles using a drilling or boring motion</td>
</tr>
<tr>
<td>Piling – driven</td>
<td>A method of inserting piles using a driving or hammering motion</td>
</tr>
<tr>
<td>PM period peak</td>
<td>3pm – 6 pm weekdays</td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>Particulate matter less than 10 microns in diameter</td>
</tr>
<tr>
<td>Preliminary CSM</td>
<td>Preliminary conceptual site model</td>
</tr>
<tr>
<td>Stage 1 Project</td>
<td>Northern Beaches Hospital Road Connectivity and Network Enhancement Project – Stage 1</td>
</tr>
<tr>
<td>Stage 2 Project</td>
<td>Northern Beaches Hospital Road Connectivity and Network Enhancement Project – Stage 2</td>
</tr>
<tr>
<td>Proponent</td>
<td>For this project, the person or organisation that proposes carrying out a project or activity</td>
</tr>
<tr>
<td>RBL</td>
<td>Rating background level</td>
</tr>
<tr>
<td></td>
<td>This is the median noise value of the assessment background levels values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night-time</td>
</tr>
<tr>
<td>Receptor/receiver</td>
<td>An environmental modelling term used to describe a map reference point where the impact is predicted. A sensitive receptor is a home, workplace, school or other place where people spend some time. An elevated receptor is a point above ground level</td>
</tr>
<tr>
<td>Roads and Maritime</td>
<td>(NSW) Roads and Maritime Services</td>
</tr>
<tr>
<td>RTA</td>
<td>(NSW) Roads and Traffic Authority (former)</td>
</tr>
<tr>
<td>RWMP</td>
<td>Resource and Waste Management Plan</td>
</tr>
<tr>
<td>SEARs</td>
<td>Secretary’s Environmental Assessment Requirements</td>
</tr>
<tr>
<td>SEPP</td>
<td>State Environmental Planning Policy</td>
</tr>
<tr>
<td>Shared path</td>
<td>The portion of the carriageway for use by pedestrians and cyclists, that is beyond the traffic lanes in the footpath reservation adjacent to the surface of the pavement</td>
</tr>
<tr>
<td>SHOROC</td>
<td>Shore Regional Organisation of Councils</td>
</tr>
<tr>
<td>Slot</td>
<td>A roadway that contains auxiliary traffic lanes which are located at a lower level to primary traffic lanes</td>
</tr>
<tr>
<td>Term</td>
<td>Meaning</td>
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<tr>
<td>SoHI</td>
<td>Statement of Heritage Impact</td>
</tr>
<tr>
<td>Spoil</td>
<td>Surplus excavated material</td>
</tr>
<tr>
<td>SRD SEPP</td>
<td>State Environmental Planning Policy (State and Regional Development) 2011</td>
</tr>
<tr>
<td>SSI</td>
<td>State Significant Infrastructure</td>
</tr>
<tr>
<td>State Infrastructure Strategy</td>
<td>State Infrastructure Strategy 2012-2032</td>
</tr>
<tr>
<td>Stockpile</td>
<td>Temporarily stored materials such as soil, sand, gravel and spoil/waste</td>
</tr>
<tr>
<td>Swale</td>
<td>A shallow, grass-lined drainage channel</td>
</tr>
<tr>
<td>TAGG</td>
<td>Transport Authorities Greenhouse Group</td>
</tr>
<tr>
<td>tCO2-e</td>
<td>Carbon dioxide equivalent emissions</td>
</tr>
<tr>
<td>TFNSW</td>
<td>Transport for NSW</td>
</tr>
<tr>
<td>Threatened</td>
<td>As defined under the Threatened Species Conservation Act 1995, a species, population or ecological community is threatened when it is likely to become extinct or is in immediate danger of extinction</td>
</tr>
<tr>
<td>TSC Act</td>
<td>(NSW) Threatened Species Conservation Act 1995</td>
</tr>
<tr>
<td>Typical cross section</td>
<td>A cross section of a carriageway showing typical dimensional details, furniture locations and features of the pavement construction</td>
</tr>
<tr>
<td>Turbidity</td>
<td>A measure of water clarity or murkiness</td>
</tr>
<tr>
<td>Underpass</td>
<td>A roadway that passes under another road or intersection</td>
</tr>
<tr>
<td>Urban design</td>
<td>The process and product of designing human settlements, and their supporting infrastructure, in urban and rural environments</td>
</tr>
<tr>
<td>VAP</td>
<td>Visual Assessment Precinct</td>
</tr>
<tr>
<td>VCZ</td>
<td>Visual Catchment Zone</td>
</tr>
<tr>
<td>VENM</td>
<td>Virgin Excavated Natural Material</td>
</tr>
<tr>
<td>Viaduct</td>
<td>A long bridge, generally composed of a series of spans over land, which carries a road or railway</td>
</tr>
<tr>
<td>Water table</td>
<td>The surface of saturation in an unconfined aquifer at which the pressure of the water is equal to that of the atmosphere</td>
</tr>
<tr>
<td>Wetland</td>
<td>Wetlands are areas of land where water covers the soil throughout the year or at certain times of the year</td>
</tr>
</tbody>
</table>
1 Introduction

This section introduces the project, providing a brief outline of its need, scope and location. It also outlines the structure of this environmental impact statement (EIS).

1.1 Project application

Roads and Maritime Services (Roads and Maritime) is seeking project approval for the Northern Beaches Hospital Road Connectivity and Network Enhancement Project – Stage 2 (Stage 2 Project). The approval is sought under Part 5.1 (State significant infrastructure) of the Environmental Planning and Assessment Act 1979 (NSW) (EP&A Act).

1.1.1 Project context

The Northern Beaches Hospital (NBH) is being constructed at the intersections of Warringah Road with Wakehurst Parkway and Frenchs Forest Road West on an area of land between Wakehurst Parkway and The Forest High School. The hospital concept proposal and the first stage (clearing) of the hospital site were approved on 22 June 2014. The second stage of the Northern Beaches Hospital project for hospital construction was approved on 29 June 2015.

To support the hospital opening, consideration was given to road based improvements aimed at meeting the needs of the road network both in the Northern Beaches Hospital Precinct and across the regional road network. Investigations carried out by Roads and Maritime identified that, in order to support access to the hospital, while at the same time minimising impacts on the existing road network, various improvements would be required within the Northern Beaches Hospital Precinct. The Northern Beaches Hospital Road Connectivity and Network Enhancement Project (Concept Proposal) was developed to address the requirements of the hospital and to enhance the currently constrained road network to accommodate additional traffic generated by the hospital project.

The Concept Proposal aims are to:

- Assist in the management of journeys in connection with anticipated future intensification of medical, commercial and residential land uses surrounding the new hospital
- Mitigate the worsening of traffic congestion on the Warringah Road and Wakehurst Parkway arterial road corridors and their principal feeder roads
- Enhance access arrangements by car, bus and active transport for the Northern Beaches Hospital employees, patients, outpatients and visitors
- Facilitate improved access to the Northern Beaches Hospital and the surrounding employment precincts
- Have key infrastructure components in place for the hospital opening in 2018.

A schematic of the Concept Proposal is shown in Figure 1.1.
The Forest High School
Frenchs Forest Public School
Wakehurst Parkway
Frenchs Forest Road East
Frenchs Forest Road West
Naree Road
Forest Way
Fitzpatrick Avenue East
Bantry Bay Road
Maxwell Parade
Wakehurst Parkway
Allambie Road
Aquatic Drive
Warringah Road
Rodborough Road
CHATSWOOD
DEE WHY

Stage 1 Project
Hospital Connectivity Work

Stage 2 Project
Network Enhancement Work
Underpass for through traffic
Shared pedestrian and cycle bridge

KEY

Stage 1 Project
Hospital Connectivity Work

Stage 2 Project
Network Enhancement Work
Underpass for through traffic
Shared pedestrian and cycle bridge

- New on-ramp from Wakehurst Parkway southbound into the slot westbound
- Widening and upgrade along Warringah Road at surface
- Proposed shared pedestrian / cyclist bridge
- New on-ramp Wakehurst Parkway
- New shared path east side of Wakehurst Parkway
- New shared path west side of Allambie Road
- New shared path east side and footpath west side of Forest Way
- Through traffic on Warringah Road separated from turning traffic at Forest Way by way of an underpass
- Through traffic on Warringah Road separated from turning traffic at Hilmer Street by way of an underpass
- Through traffic on Warringah Road separated from turning traffic at Wakehurst Parkway by way of an underpass
- Through traffic on Warringah Road separated from turning traffic at Hilmer Street by way of an underpass
- New footpath north side Aquatic Drive
- Connecting Aquatic Drive with Wakehurst Parkway
- Widening of Allambie Road south of Warringah Road
- Remove existing pedestrian bridge and replace with shared pedestrian / cyclist bridge
- New shared path east side of Wakehurst Parkway
- New shared path west side of Allambie Road
- New shared path east side and footpath west side of Forest Way
- Through traffic on Warringah Road separated from turning traffic at Forest Way by way of an underpass
The Concept and Stage 1 Project Hospital Connectivity Works was approved on 29 June 2015. The Concept Proposal is being assessed in two stages under section 115ZD of the EP&A Act. Roads and Maritime sought approval under Part 5.1 (State significant infrastructure) of the NSW EP&A Act for each of the two stages comprising the Concept Proposal, being:

- Stage 1 Hospital Connectivity Work (Stage 1 Project), being the provision of essential road work to enhance connectivity to the hospital (now approved)
- Stage 2 Network Enhancement Work (Stage 2 Project), to improve the broader network capacity:
  - SSI application number SSI 6622
  - The subject of this EIS.

Collectively these comprise the Concept Proposal.

The Northern Beaches Hospital Road Connectivity and Network Enhancement Project EIS (Roads and Maritime, 2014), placed on public exhibition in October 2014, supported the Concept Proposal and Stage 1 Project application. The EIS assessed the Concept Proposal at a strategic concept level and provided a more detailed environmental assessment of the Stage 1 Project. The approved Stage 1 Project will proceed to construction in the second half of 2015.

The Stage 1 Project will be constructed generally along the Naree Road and Frenchs Forest Road corridor and intersections with Forest Way, the hospital, Wakehurst Parkway, Allambie Road and Warringah Road. More specific detail and assessment is provided on the Stage 1 Project in the Northern Beaches Hospital Road Connectivity and Network Enhancement Project EIS (Roads and Maritime, October 2014).

A detailed description of the Stage 2 Project is provided in Section 5. This EIS provides a detailed environmental assessment of the Stage 2 Project. Subject to approval, this would enable the Stage 2 Project to proceed to construction.

1.2 The proposed project

The Stage 2 Project is directed towards broader network capacity enhancement particularly along Warringah Road. The project comprises road upgrades to enhance the existing road network surrounding the Northern Beaches Hospital at Frenchs Forest, within the Warringah local government area (LGA) on Sydney’s Northern Beaches (refer to Figure 1.1).

The Stage 2 Project would include:

- Provision of four through lanes on Warringah Road (two lanes in each direction for east-west through traffic) within a grade separated open slot for about 1.3 kilometres
- Ingress and egress points from and to the slot include:
  - Western extent – Warringah Road near Fitzpatrick Avenue East
  - Eastern extent – Warringah Road from about 350 metres east of the Wakehurst Parkway grade separated intersection
  - Provision of a two-lane on-ramp (merging into one lane) from Wakehurst Parkway (southbound) into the slot (westbound)
- Widening of Warringah Road from west of Fitzpatrick Avenue East to west of Allambie Road to include:
- Westbound travel lanes, at surface level on the southern side of the Warringah Road corridor for the length of the project
- Eastbound travel lanes, at surface level on the northern side of the Warringah Road corridor (using existing road pavement), for the length of the project

- Construction of surface level bridges over the slot at the intersections of Warringah Road with Forest Way, Hilmer Street and Wakehurst Parkway to provide for all traffic movements at surface level and allow uninterrupted east-west through traffic in the slot

- Upgrades or adjustments to existing intersections of Warringah Road with the following local roads and approaches:
  - Fitzpatrick Avenue East (including the closing of the left turn into Fitzpatrick Avenue East from Warringah Road westbound)
  - Rodborough Road
  - Allambie Road

- Widening of Wakehurst Parkway from the intersection of Warringah Road to south of Aquatic Drive

- Provision of a new connection at Aquatic Drive including right in from Wakehurst Parkway (northbound), left in from Wakehurst Parkway (southbound) and left out from Aquatic Drive onto Wakehurst Parkway (southbound)

- Lengthening the bus stop on the eastern side of Forest Way

- Provision of shared (pedestrian and cyclist) bridges at the following locations:
  - Across Warringah Road west of the intersection of Forest Way (removal and replacement of the existing pedestrian bridge)
  - Across Warringah Road on the western side of the intersection with Hilmer Street (new pedestrian bridge)

- Removal of the existing pedestrian crossing across Warringah Road at Hilmer Street

- Shared paths and footpaths on sections of Warringah Road, Wakehurst Parkway, Forest Way, Aquatic Drive and Allambie Road.

The Stage 2 Project would also include drainage work, landscaping, property acquisition and adjustments. The ancillary work would include but not be limited to, construction compounds, and stockpile sites. For the purposes of this EIS, the scope of the Stage 2 Project would not include ongoing maintenance work.

### 1.3 Project location

The Stage 2 Project is located in the suburb of Frenchs Forest within the Warringah LGA, which is part of the North Sub-region in A Plan For Growing Sydney\(^2\) (NSW Government, 2014), commonly known as the Northern Beaches. The suburb of Frenchs Forest is straddled by Garigal National Park and Middle Harbour, and is dotted with playing fields, parks and remnant bushland.

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\(^2\) This was released in December 2014 and replaced the Draft Metropolitan Strategy for Sydney to 2031
Colloquially known as ‘the Forest’, the suburb is centrally located between the beaches of Dee Why and Curl Curl, and metropolitan Chatswood.

The existing road network comprises Warringah Road from west of Fitzpatrick Avenue to the west of Allambie Road; Forest Way from Warringah Road to north of Rabbett Street (Stage 1 Project tie-in); Wakehurst Parkway from intersection with Warringah Road to south of Aquatic Drive; Aquatic Drive for 150 metres from the Wakehurst Parkway intersection; and Allambie Road from Warringah Road to Rodborough Road.

This road network is an important transport linkage for north-south and east-west traffic movement to and from the Northern Beaches.

Surrounding land uses are diverse and include low density residential, commercial uses, office buildings, light industrial warehousing (sometimes with an ancillary office component), educational establishments, open space, bushland, utilities, places of worship and recreational facilities.

Three distinct business parks are located within the Northern Beaches Hospital Precinct, with each being characterised by two to three storey office buildings many of which are attached to high ceiling warehouses. These business parks appear to serve as a regional headquarters and distribution hub for national and international businesses. These business parks also accommodate a range of other commercial and recreational businesses serving the needs of the surrounding local and sub-regional population.

The indicative location of the Stage 2 Project is shown in Figure 1.2.
Northern Beaches Hospital Connectivity and Network Enhancements Project location

LOCATION OF THE PROJECT

- Hospital connectivity works
- Network enhancement works
1.4 Structure of this environmental impact statement

This EIS has been prepared to address the Secretary’s Environmental Assessment Requirements (SEARs) issued by the Secretary of the Department of Planning and Environment (DP&E) on 10 September 2014 (and the supplementary SEARs dated 18 May 2015) and the relevant provisions of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (NSW).

The EIS is divided into three volumes.

Volume 1 has the following structure:

- **Introduction** – provides a broad overview of the Stage 2 Project and where it is located (Section 1)
- **Assessment process** – outlines the statutory requirements and explains the steps in the assessment and approval process (Section 2)
- **Strategic justification and project need** – provides the strategic context, explains the need for Stage 2 Project and identifies the project objectives (Section 3)
- **Project development and alternatives** – reviews the alternatives and options considered in developing the Stage 2 Project including the consequences of not proceeding (Section 4)
- **Project description** – provides a detailed description of the Stage 2 Project including the route alignment, design standards, key design features and construction methodologies and staging (Section 5)
- **Consultation** – outlines the consultation activities carried out in relation to the Stage 2 Project, issues raised and how these have been addressed (Section 6)
- **Assessment of environmental issues** – identifies the key environmental issues associated with the Stage 2 Project, assesses the impacts and proposes environmental management measures (Section 7 to Section 20)
- **Summary of environmental management measures** – collates all of the environmental management measures for the Stage 2 Project identified through the impact assessment process (Section 21)
- **Environmental risk analysis** – details the risk analysis process by which the potential environmental issues for assessment of the Concept Proposal and the Stage 2 Project were identified (Section 22)
- **Project justification and conclusion** – presents the justification for the Stage 2 Project, including consideration of the principles of ecologically sustainable development and the objects of the EP&A Act (Section 23)
- **References.**

Volume 1 contains the following appendices in support of the EIS:

- **Appendix A** Secretary’s Environmental Assessment Requirements (SEARs) (including the supplementary SEARs) and checklist
- **Appendix B** Environmental Planning and Assessment Regulation 2000 checklist
Volume 2 contains the following appendices in support of the EIS:

Appendix C  Technical working paper: Traffic and Transport
Appendix D  Technical working paper: Noise and vibration
Appendix E  Technical working paper: Biodiversity

Volume 3 contains the following appendices in support of the EIS:

Appendix F  Technical working paper: Socio-economic, land use and property
Appendix G  Technical working paper: Landscape character and visual impact
Appendix H  Technical working paper: Aboriginal heritage
Appendix I  Technical working paper: Non-Aboriginal heritage
Appendix J  Technical working paper: Air quality
Appendix K  Technical working paper: Phase 2 contamination investigations
Appendix L  Technical working paper: Hydrology, surface water and flooding
Appendix M  Technical working paper: Groundwater
2 Assessment process

2.1 Approval framework

2.1.1 Environmental Planning and Assessment Act 1979

Part 5.1 of the EP&A Act

Roads and Maritime is seeking approval for the Stage 2 Project under Part 5.1 (State significant infrastructure) of the EP&A Act.

Section 115U(2) of the EP&A Act provides that a State Environmental Planning Policy (SEPP) may declare any development, or any class or description of development, to be State significant infrastructure (SSI).

Clause 14 of the State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) declares development, pursuant to section 115U(2) of the EP&A Act, to be SSI if:

a. the development on the land concerned is, by the operation of a SEPP, permissible without development consent under Part 4 of the EP&A Act; and

b. the development is specified in Schedule 3 of the SRD SEPP.

The Stage 2 Project falls within the category of development that is permissible without consent pursuant to clause 94 of State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP). Clause 94 applies to development for the purpose of a ‘road’ or ‘road infrastructure facilities’ and provides that such development, when carried out by or on behalf of a public authority, is permissible without consent. The Stage 2 Project is for the purpose of a ‘road’ or ‘road infrastructure facility’ under the Infrastructure SEPP.

The Stage 2 Project also falls within clause 1 of Schedule 3 of the SRD SEPP. This clause of Schedule 3 identifies as SSI, infrastructure or other development that (but for Part 5.1 of the EP&A Act and within the meaning of Part 5 of the EP&A Act) would be an activity for which the proponent is also the determining authority and would, in the opinion of the proponent, require an environmental impact statement to be obtained under Part 5 of the EP&A Act. The Stage 2 Project falls within this category of development and would require an environmental impact statement to be prepared under Part 5 of the EP&A Act.

Separately to the operation of section 115U(2) of the EP&A Act, section 115U(4) of the EP&A Act provides that:

a. specified development on specified land is SSI if it is specifically declared to be SSI; and

b. any such declaration may be made by a SEPP or by an order of the Minister (published on the NSW legislation website) that amends a SEPP for that purpose.

It is noted that parts of the road network which are the subject of the Stage 2 Project fall within the Northern Beaches Hospital Precinct identified under the SRD SEPP. Development within that Precinct, which meets relevant criteria, is declared to be SSI by clause 15 of the SRD SEPP.
Clause 15 provides that development specified in Schedule 4 of that SEPP is declared to be SSI pursuant to section 115U(4) of the EP&A Act. Part 2 of Schedule 4 of the SRD SEPP declares as SSI:

_Devvelopment carried out by or on behalf of a public authority that has a capital investment value of more than $30 million on land identified as being within the Northern Beaches Hospital Precinct on the State Significant Infrastructure Sites Map._

Those components of the Stage 2 Project which fall within the Northern Beaches Hospital Precinct have a capital investment value exceeding $30 million.

While section 115U(4) operates to declare parts of the Stage 2 Project development as SSI, section 115U(2) of the EP&A Act, and the declaration under clause 14 of the SRD SEPP, applies to declare the entirety of the Stage 2 Project as SSI.

The approval process under Part 5.1 of the EP&A Act is illustrated in Figure 2.1. Further information on the assessment process is available on the DP&E website³.

**Section 115ZD of the EP&A Act**

Roads and Maritime seeks approval of the Stage 2 Project. A Concept Proposal staged infrastructure application has been sought under section 115ZD of the EP&A Act.

³ www.planning.nsw.gov.au
**Figure 2.1** Approval process under Part 5.1 of the EP&A Act
2.2 Other legislation

2.2.1 NSW legislation

A number of approvals are not required for SSI approved under Part 5.1 of the EP&A Act (EP&A Act, section 115ZG). The applicable approvals which are not required for the Stage 2 Project are:

- Approvals under Part 4 and excavation permits under section 139 of the Heritage Act 1977
- Authorisations referred to in section 12 of the Native Vegetation Act 2003 to clear native vegetation on State protected land
- A water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the Water Management Act 2000.

Approvals under other NSW legislation that may apply to the Stage 2 Project include:

- An approval under the Crown Lands Act 1989 to grant a relevant interest (i.e. licence, permit, easement or right of way) over a Crown Reserve
- An aquifer interference approval under the Water Management Act 2000 as construction requires intersection of a groundwater source.

Other legislation that may apply to the Stage 2 Project includes:

- Land Acquisition (Just Terms Compensation) Act 1991 – land acquisition is further discussed in Section 5.1.3 and Section 10 of this EIS
- Contaminated Land Management Act 1997 – contamination of land is further discussed in Section 15.

An environment protection licence (EPL) under Chapter 3 of the Protection of the Environment Operations Act 1997 (POEO Act) for road construction would also be required. In accordance with section 115ZH of the EP&A Act, such a licence cannot be refused if it is necessary to carry out approved SSI project and is to be substantially consistent with the SSI approval.

2.2.2 Warringah Local Environmental Plan 2011

The Stage 2 Project is located within the Warringah LGA. The Warringah Local Environment Plan (LEP) 2011 guides land use planning in order to ensure the most efficient and harmonious use of land. The LEP identifies the following zoning within the Stage 2 Project area:

- Warringah Road, Forest Way and Wakehurst Parkway are zoned SP2 – Infrastructure. The areas immediately adjacent to these roads are zoned RE1 – Public Recreation
- The Forestway Shopping Centre is zoned B2 – Commercial Core
- The service station and the Bantry Bay Road shops on the southern side of Warringah Road (opposite the Northern Beaches Hospital site) are zoned B1 – Neighbourhood Centre.

The majority of the Stage 2 Project area is currently zoned for infrastructure or is within existing road corridors. Some minor widening of the road corridor may require acquisition or re-zoning of adjacent land uses. Land acquisition is discussed further in Section 5.1.13 and Section 10.
2.3 Commonwealth legislation

Under the *Environment Protection and Biodiversity Act 1999* (EPBC Act) proposed 'actions' that have, will have or are likely to have a significant impact on matters of national environmental significance, the environment of Commonwealth land or that are being carried out by a Commonwealth agency must be referred to the Australian Government Department of the Environment. If the Australian Minister for the Environment determines that a referred project is a 'controlled action', the approval of that Minister would be required for the project in addition to the approval of the NSW Minister for Planning.

Based on the results of the environmental investigations carried out for this EIS, it is considered that no matters of national environmental significance or areas of Commonwealth land are likely to be significantly impacted by the Stage 2 Project. Accordingly, a referral is not required.
3 Strategic justification and project need

This section outlines the relationship of the project to the strategic planning framework. It also identifies the need for the project and the project objectives. A statement of strategic need concludes the section.

<table>
<thead>
<tr>
<th>Secretary’s Environmental Assessment Requirements</th>
<th>Where addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>A statement of the objectives of the proposal, including a description of the strategic need, justification, objectives and outcomes for the proposal,</td>
<td>Section 3.3</td>
</tr>
<tr>
<td>taking into account existing and proposed transport infrastructure and services within the adjoining subregions,</td>
<td>Section 3.2</td>
</tr>
<tr>
<td>and as relevant outcomes and objectives of relevant strategic planning and transport policies, including, but not limited to, NSW 2021, NSW Government State Infrastructure Strategy, NSW Long Term Transport Master Plan (December 2012), draft Metropolitan Plan for Sydney (March 2013) and any other relevant plans;</td>
<td>Section 3.1</td>
</tr>
</tbody>
</table>

3.1 NSW and Australian strategic planning and policy framework

3.1.1 NSW Long Term Transport Master Plan

The *NSW Long Term Transport Master Plan* (Transport for NSW, 2012) provides a framework to deliver an integrated, modern transport system by identifying NSW’s transport actions and investment priorities over the next 20 years.

The Long Term Transport Master Plan identifies that over the next 20 years, Sydney’s population is forecast to increase from 4.3 million to 5.6 million. By 2031, the number of trips made around the city each day will increase by 31 per cent from 16 to 21 million trips, placing greater demands on our road, rail and bus networks. Road congestion is currently estimated to have a cost of about $5.1 billion (or nearly $1,100 for every person living in Sydney) each year. By 2020, the costs of congestion are expected to rise to $8.8 billion a year.

The Long Term Transport Master Plan proposes a coordinated and integrated approach to meeting these transport challenges. Actions outlined in the plan include a program of work to expand capacity on Sydney’s most congested corridors. A medium to long-term action to deliver targeted investment and efficiency improvements on the arterial road network is relevant to the project.

Across Sydney’s Greater Metropolitan Area, the Long Term Transport Master Plan identifies 46 strategic transport corridors that represent travel demands between centres in Metropolitan Sydney and areas where high concentrations of travel demand occur during peak periods on all travel modes. The transport corridor connecting Dee Why and Chatswood through Frenchs Forest is identified as one of these strategic transport corridors. The Long Term Transport Master Plan identifies that on Warringah Road between Frenchs Forest and Brookvale, the average travel speed in the morning peak is currently about 32 km/h. Forecasts for strong growth in traffic over the next 20 years means that road congestion in this corridor will get worse unless action is taken.
In addition, the road corridor along Warringah Road between Dee Why and Chatswood is identified as having the potential to be expanded as part of the Strategic Transit Network. This may include a Northern Beaches Bus Rapid Transit along the Warringah Road Corridor. Under the Long Term Transport Master Plan Warringah Road, between Chatswood and Dee Why, and Wakehurst Parkway up to Belrose, is proposed to be part of the core bus network by 2031.

The Stage 2 Project would assist in implementing this.

### 3.1.2 NSW 2021 – A plan to make NSW number one

*NSW 2021: A plan to make NSW number one* (NSW Department of Premier and Cabinet, 2011) is the NSW Government’s 10 year strategic business plan which sets priorities for action and guides resource allocation to deliver economic growth and critical infrastructure.

The NSW 2021 Performance Report (NSW Department of Premier and Cabinet, 2012) sets baselines and provides information on how the NSW Government intends to measure and deliver on the goals, targets and measures outlined in NSW 2021.

NSW 2021 places emphasis on investing in and delivering an efficient and effective transport system including delivering road infrastructure that will relieve congestion, improve travel times, improve road safety and enhance and expand capacity on road corridors.

Within the context of NSW 2021, the Stage 2 Project would help to achieve priority actions within NSW 2021, specifically including:

- **Goal 7:**
  - Reduce travel times
  - Improve morning and evening peak hour period travel speeds on 100 major road corridors; deliver road infrastructure to relieve congestion, improve safety and enhance and expand capacity on road corridors.

- **Goal 8:**
  - Grow patronage on public transport by making it a more attractive choice
  - Increase the share of commuter trips made by public transport and increase the proportion of total journeys to work by public transport in the Sydney Metropolitan Region.

- **Goal 10:**
  - Improve road safety
  - Improve the safety of roads by carrying out road development, upgrading, maintenance and safety work; and cut congestion and introduce safe, simpler speed zones to save lives.

- **Goal 19:**
  - Invest in critical infrastructure
  - Improve the quality of urban and rural state roads.

- **Goal 32:**
  - Involve the community in decision making on government policy, services and projects
  - Increase the proportion of people who feel able to have a say on issues that are important to them and increase the number of submissions received from the community.
The Stage 2 Project is consistent with NSW 2021 by upgrading road infrastructure which would enhance and expand capacity on road corridors, improve safety and reduce congestion. The Stage 2 Project would also provide infrastructure to enable access to the Northern Beaches Hospital and the surrounding precinct. In addition, Roads and Maritime has been actively consulting the local community and stakeholders in the development of the Stage 2 Project (refer to Section 6.3).

3.1.3 NSW State Infrastructure Strategy

*The State Infrastructure Strategy 2012–2032* (Infrastructure NSW, 2012) (State Infrastructure Strategy) is a 20 year strategy which identifies and prioritises the delivery of critical public infrastructure to drive productivity and economic growth. The State Infrastructure Strategy identifies strategic infrastructure options to meet the challenges of population growth across NSW.

Infrastructure NSW’s assessment of the State’s existing infrastructure highlighted critical deficiencies in urban road capacity. The State Infrastructure Strategy identifies that in Greater Sydney over 93 per cent of journeys use roads and concludes that investment in new and upgraded roads is essential to meet the transport task in Greater Sydney. It also concludes road transport is, and will remain, the only viable option for most journeys in Sydney most of the time.

The Stage 2 Project area includes a number of major arterial roads connecting the Northern Beaches to the Sydney CBD, Chatswood and Macquarie Park areas. The Stage 2 Project is consistent with the State Infrastructure Strategy as it would assist in the upgrading of these roads to provide for future traffic growth and transport requirements in Greater Sydney.

The State Infrastructure Strategy also identifies the Northern Beaches Hospital as an important aspect of health infrastructure for the future of the Northern Beaches. The NSW Government has announced a program for major new hospitals and NSW health investment of around $10 billion in the next 10 years. The Stage 2 Project is consistent with this aspect of the strategy as it provides public connectivity to the Northern Beaches Hospital and enhances the road network capacity within the Northern Beaches Hospital precinct.

3.1.4 A Plan For Growing Sydney

*A Plan For Growing Sydney* (The Plan) (NSW Government, 2014) was released in December 2014 and replaced the *Draft Metropolitan Strategy for Sydney to 2031*. The Plan is intended to guide land use planning decision-making for the next 20 years. It provides a framework based around four key goals to develop a competitive economy with world-class services and transport; to deliver greater housing choice to meet changing needs and lifestyles; to create communities that have a strong sense of wellbeing; and to safeguard the natural environment.

*A Plan For Growing Sydney* will be delivered in conjunction with the Long Term Transport Master Plan and State Infrastructure Strategy to fully integrate planning for housing and employment with the delivery of transport and infrastructure. The Plan establishes four goals to achieve the Government’s vision for Sydney as ‘a strong global city, a great place to live’ and sets out actions that will deliver these goals. Each goal has a number of priority areas which are directions that provide a focus for the actions.

*A Plan For Growing Sydney* identifies specific locations as ‘Strategic Centres’, these being locations that currently or are planned to have least 10,000 jobs. These are areas of intense, mixed economic and social activity that are built around the transport network and feature major public investment in services such as hospitals and education and sports facilities. Direction 1.7
sits under the goal of delivering a competitive economy with world-class services and transport, by growing these strategic centres.

The Northern Beaches Hospital Precinct is identified as a Strategic Centre with the following priorities relating directly to the Concept Proposal:

- Progress planning for road improvements supporting Northern Beaches Hospital Precinct, including underpasses on Warringah Road at Forest Way and Wakehurst Parkway
- Progress planning for a new public transport interchange servicing Northern Beaches Hospital Precinct
- Improve walking and cycling connections between the different parts of Northern Beaches Hospital Precinct and to its surrounding area.

Direction 1.11 addresses the delivery of infrastructure with one of the supporting actions (1.11.1) focused on preserving future transport and road corridors to support future growth. The Plan identifies the Warringah Road corridor between Brookvale/Dee Why and Chatswood as ‘Transit Investigations’ and accords with the strategy presented in *Sydney’s Bus Future* (refer Section 3.1.7).

The Stage 2 Project is consistent with the objectives of *A Plan For Growing Sydney*:

- Through development of the Stage 2 Project design:
  - Being carried out in consultation with key stakeholders, including Warringah Council and (where possible) in consideration of Council’s advice of potential elements being considered in the Warringah Council Structure Plan
  - Being prepared in consideration of land use requirements for both existing (The Forest High School, French Forest Public School, residential, business and industrial) and future (hospital) land uses.
- By providing network enhancement along the road corridor connecting the Northern Beaches with the Sydney CBD, Chatswood and Macquarie Park areas.

### 3.1.5 Shore Regional Organisation of Councils

The Shore Regional Organisation of Councils (SHOROC) is a partnership between Manly, Mosman, Pittwater and Warringah Councils on Sydney’s North Shore. These councils work together to identify key infrastructure and policy priorities for the future of the region. In 2010, SHOROC produced the *Shaping Our Future – Directions for transport, health, housing and jobs for a vibrant sustainable SHOROC region* (SHOROC, 2010). The report aims to address the need for better public transport, roads and health services.

The key priorities identified in the report include:

- Immediate construction of the Northern Beaches Hospital at Frenchs Forest
- Constructing a Bus Rapid Transit system for fast reliable public transport from Mona Vale to the City and from Dee Why to Chatswood
- Road upgrades for Warringah Road particularly the intersections with Wakehurst Parkway and Forest Way, including in the short term (0-5 years) a grade separated intersection at both of these intersections and upgrades to Wakehurst Parkway to provide flood-free access, critical to the operation of the Northern Beaches Hospital at Frenchs Forest.
The Stage 2 Project is largely compatible with these priorities. In relation to the provision of flood-free access to Wakehurst Parkway, Roads and Maritime is investigating options to reduce the impact of flooding on Wakehurst Parkway.

3.1.6 NSW 2021 Northern Beaches Regional Action Plan

The *NSW 2021 Northern Beaches Regional Action Plan* (Action Plan) has been prepared by SHOROC. The Action Plan outlines the initiatives and strategies proposed to be pursued by the NSW Government to meet the short term and long term visions for the region. Relevant to the Stage 2 Project, the Action Plan specifically requires agencies to:

- Plan for and construct the Northern Beaches Hospital at Frenchs Forest and the surrounding health precinct
- Address traffic and transport issues around the new hospital
- Investigate Bus Rapid Transit for the Northern Beaches.

The Stage 2 Project provides suitable capacity to cater for road based public transport.

3.1.7 Sydney’s Bus Future

*Sydney’s Bus Future* (Transport for NSW, 2013) sets out the Government’s overall plan to deliver fast and reliable bus services for customers in Sydney. Based on the integrated approach outlined in the NSW Long Term Transport Master Plan, the plan outlines how the bus network would be redeveloped to bring simpler, faster and more efficient services. It identifies three tiers of bus routes in the network:

- **Rapid service routes**, forming the backbone of the bus network with fast and reliable bus travel between key centres. A total of 13 rapid transit routes have been identified. These would have stops every 800 metres to one kilometre
- **Suburban service routes**, consisting of a mix of timetabled and frequent, ‘turn-up-and-go’ type services which do not require timetables
- **Local service routes**, comprised of timetabled services with stops every 400 metres or so.

Sydney’s Bus Future also outlines investment in bus priority infrastructure to support fast and reliable bus journeys. As discussed above, this includes adopting a staged approach to introducing Bus Rapid Transit on key corridors, beginning with investigations along key high-growth corridors. These corridors include the Northern Beaches.

Frenchs Forest is identified in the plan as a ‘specialised centre’ and lined by improved suburban routes via Warringah Road and Forest Way with the ‘major centres’ of Brookvale, Dee Why and Chatswood.

The Stage 2 Project design provides suitable capacity to cater for road-based public transport.

In addition, Transport for NSW is working closely with Warringah Council and Roads and Maritime to progress the identification and investigation of longer term bus servicing scenarios for the Frenchs Forest precinct to complement the Concept proposal. Potential bus network changes and service improvements at this early stage include the consideration of a peak period cross-regional (Dee Why–Frenchs Forest–Chatswood) express services using Warringah Road rather than Frenchs Forest Road and a creation of a new east-west bus route (to operate parallel with Frenchs Forest Road and Warringah Road). Also the conversion of Warringah Road surface-level kerbside lanes, and/or the reconfiguration of signalised intersections, to support peak period bus
priority operations is being investigated however any provision of such facilities would be subject to an assessment of customer demand and a review of wider road network impacts.

3.1.8 Road safety strategies

Working towards safer roads is a major component of the National Road Safety Strategy 2011 – 2020 (National Road Safety Strategy) (Australian Transport Council, 2011). The National Road Safety Strategy indicates that infrastructure improvements can have a major influence in preventing crashes or minimising the consequences of a crash.

In addition, the Road Safety Strategy for NSW 2012 – 2021 (Transport for NSW, 2012) aims to reduce fatalities and serious injuries by 30 per cent by 2021. It identifies that achieving this goal will require ongoing investment to improve road infrastructure.

Given that road infrastructure has a life of 25 years or more, the investment in infrastructure improvement will continue to save lives and avoid serious injuries well into the future. By relieving road congestion (and thereby travel reliability and safety of travel on roads within the Stage 2 Project area), the delivery of the Stage 2 Project is consistent with the overarching road safety directions identified in the National Road Safety Strategy and the NSW Road Safety Strategy.

3.1.9 Action for Air and the NSW Greenhouse Plan

The NSW Government initiative Action for Air (Action for Air) was last updated in 2009 (former Department of Environment, Climate Change and Water, 2009). Action for Air is a 25-year plan to improve air quality in the Greater Metropolitan Region and identifies the reduction of motor vehicle emissions as a priority action and sets specific targets for reducing the per capita vehicle kilometres travelled.

The NSW Greenhouse Plan (NSW Greenhouse Office, 2005) provides a framework for NSW Government action to reduce greenhouse emissions from its own activities and to work with other stakeholders to reduce emissions from theirs. The plan specifically recognises the need to curb growth in transport emissions.

The Stage 2 Project would support approaches within Action for Air and the NSW Greenhouse Plan by improving the efficiency of traffic movements within the corridor. It would ease traffic congestion, which is anticipated to result in lower vehicle emissions for each vehicle kilometre travelled.

3.2 Project need

3.2.1 Northern Beaches Hospital

Planning for a new major hospital on the Northern Beaches has been underway for some time with the NSW Government confirming selection of the Frenchs Forest site in 2006. The Northern Beaches Hospital is planned to commence operation in 2018.

The traffic analysis for the hospital concept proposal identified that at the time of hospital opening there could be up to 900 outbound trips generated by the hospital in the evening peak. It was noted that the capacity limitations of the existing major intersections to absorb hospital traffic would exacerbate existing high levels of congestion experienced during the morning and evening peak period. The hospital would therefore impact upon the already stretched existing road network.
Investigations carried out by Roads and Maritime have identified that in order to support access to the hospital while at the same time minimising impacts on the existing road network, various improvements would be required at several local intersections. The Stage 1 Project, as described in the Northern Beaches Hospital Road Connectivity and Network Enhancement Project EIS (Roads and Maritime, 2014), provides for essential road work to enhance connectivity to the hospital by 2018. However, the benefit of these would be relatively short term due to other factors, such as the proposed intensification of health/medical related developments in the Northern Beaches Hospital Precinct, in addition to the traffic growth associated with the hospital through the study area. As such, improvements to the existing road network (Stage 2 Project) would also be required to address this traffic growth and the associated significant capacity constraints.

3.2.2 Regional context

Demographic profile

Population growth within the North Subregion is expected to be modest. The North Subregional Strategy indicates a 15 per cent increase in population (an additional 40,000 people by 2036 on top of the current 238,000 population level) and a 26 per cent increase in employment (an additional 23,000 jobs by 2036 on top of the current 89,000 jobs). The majority of the employment growth is expected to occur at North Sydney, Chatswood and Dee Why/Brookvale.

While these population and employment land use forecasts do not include the new hospital, between 2011 and 2036 there is a predicted increase in the strategy of about 3,400 people and 4,900 jobs both within the surrounding Northern Beaches Hospital Precinct. This indicates a potential increase of 18 per cent and 43 per cent respectively over the next 25 years. While the forecasts do not specifically refer to the Northern Beaches Hospital, it is expected that the number of jobs generated by the hospital could be included within the proposed increase of 4,900 jobs by 2036 identified in the precinct. Estimates of this population growth have been adopted in the strategic transport model developed by Roads and Maritime, which is based on updated small-area population and employment land use scenarios (Bureau of Transport Statistics, October 2012).

This notwithstanding, given the existing levels of congestion, the low housing densities throughout the area and consequent high levels of car trip generation per household, relatively small increases in population have the potential to exacerbate existing congestion.

Transport characteristics

There are currently no rail transport options in the Northern Beaches, and the heavy reliance on private vehicle trips creates significant road traffic management issues during peak periods.

Within the Stage 2 Project area there are three major State roads influenced by transport characteristics of vehicles within and across the Northern Beaches. Key roads covered by the Stage 2 Project (refer to Figure 3.1) include:

- Warringah Road
- Wakehurst Parkway
- Forest Way.

Warringah Road is a major State Road that runs from Dee Why in the east to Roseville Chase in the west. Warringah Road is the principal component of the road network as it is the main east-west route through the study area, providing access to Brookvale/Dee Why, Chatswood and Sydney CBD via multiple routes onto the Warringah Expressway. In the vicinity of the hospital site,
Warringah Road carries 70–80,000 vehicles west of Wakehurst Parkway and 40–50,000 vehicles east of Wakehurst Parkway daily.

Wakehurst Parkway is a State Road that runs between Narrabeen in the northeast and Seaforth in the south providing further connections onto Sydney CBD via the Spit Bridge and Cremorne. In the vicinity of the hospital site, Wakehurst Parkway carries 20–30,000 vehicles daily. It is a significant component of the existing road network as it functions as one of two key north-south routes through the Stage 2 Project area. The other key north-south route is Forest Way.

Forest Way is a State Road that links Frenchs Forest and Belrose to the north, continuing onto Mona Vale Road. Forest Way carries about 45,000 vehicles daily north of Warringah Road.

Warringah Road and Forest Way are designated as higher mass limit roads (*Metropolitan Road Freight Hierarchy on the State Road Network – Practice Note* (Transport for NSW, 2011)), that can take up to 68 tonne semi-trailers and B-Double vehicles. Heavy freight vehicles make up about three to five per cent of all vehicles on these routes. The freight routes serve end destinations in the industrial and commercial areas of Frenchs Forest, Brookvale, Manly Vale, Dee Why and Warriewood.

As discussed in Section 3.1.1, the Long Term Transport Master Plan identifies the transport corridor connecting Dee Why and Chatswood, through Frenchs Forest, as a strategic transport corridor that would continue to represent travel demands between centres in Metropolitan Sydney over the long term. In addition to the existing and long term strategic transport needs both to and across the Northern Beaches Hospital Precinct, the Northern Beaches Hospital and associated precinct growth would act to generate traffic from other metropolitan centres to the Northern Beaches Hospital Precinct, further defining transport characteristics of the precinct in the long term. This would include growth for light freight associated with medical-related development throughout the precinct.
3.2.3 Existing road network

Traffic activity

The range of existing daily traffic volumes on the key roads are in the order of:

- Warringah Road: 42,000 to 79,000 vehicles per day
- Wakehurst Parkway: 20,000 to 28,000 vehicles per day
- Forest Way: 44,000 to 45,000 vehicles per day.

Figure 3.2 illustrates the daily traffic volumes throughout the existing road network in and surrounding the Northern Beaches Hospital Precinct. The highest traffic volumes are generally on Warringah Road west of Wakehurst Parkway. As discussed in Section 3.2.2, heavy freight vehicles represent between three to five per cent of all vehicles across the precinct.

![Traffic Map](image)

**Figure 3.2** Daily traffic volumes, 2012

Travel speed performance

Traffic surveys carried out by Roads and Maritime in May 2013 showed average speeds in the Northern Beaches Hospital Precinct to vary greatly by direction. Vehicle travel speeds were recorded for seven sections along Warringah Road extending from Woodland Road, Forestville in the west to Government Road, Beacon Hill in the east (a distance of about 4.7 kilometres) for morning (7:00 to 9:00am) and evening (4pm to 6pm) peak periods.
The survey results are summarised as follows:

- **Eastbound morning peak** – speeds ranged from 20 to 47 km/h; median average speed was 39 km/h
- **Eastbound evening peak** – speeds ranged from 21 to 49 km/h; median average speed was 37 km/h
- **Westbound morning peak** – speeds ranged from 13 to 51 km/h; median average speed was 35 km/h
- **Westbound evening peak** – speeds ranged from 24 to 60 km/h; median average speed was 44 km/h.

The survey results illustrate the variability of peak period average travel speeds along this section of Warringah Road. During the morning peak period, travel speeds are generally slower in both directions compared with the evening peak period. Key slow points are the eastbound approach to Forest Way and the westbound approach to Wakehurst Parkway.

**Intersection performance**

Traffic modelling was carried out to determine the existing level of service (LoS) for key intersections within the Stage 2 Project area. The model results indicate a number of key intersections around the hospital as being highly congested, indicating that drivers can experience extended delays getting through the area. Modelling results confirm the travel surveys and community feedback that the Warringah Road and Wakehurst Parkway intersection often experiences heavily congested, gridlock-like conditions, particularly during the morning peak.

**Road safety**

Of the 270 crashes recorded in the area during the period January 2010 to June 2013, half were rear-end collisions. There were no fatal crashes recorded during this period. The crash data indicates that while crashes occur throughout the area, they are also relatively concentrated at the arterial road intersections. The majority of crash clusters occurred along the Warringah Road corridor.

Approximately half of all crashes were rear-end collisions, which may be due to the existing traffic congestion during the peak periods within the study area and are typical of a congested urban road environment.

There has been no noticeable trend in the annual number of crashes over that period although the number of injury crashes shows a slight upward trend.

Typical congestion-related crash types (rear-end collisions, intersection crashes) feature on all three arterial roads. Other crash types include:

- **Warringah Road:**
  - Lane changes, likely associated with the high weaving volumes
  - Crashes involving vulnerable users (mostly cyclists)
  - Intersection approaches crashes.
- **Forest Way:**
  - Off-road and out of control on straight crashes.
Wakehurst Parkway:
- Opposing vehicles turning and intersection crashes generally
- U-turns, possibly associated with detours around gridlocked conditions.

Public transport demand and performance

There is currently no rail service on the Northern Beaches and the closest train station that bus services focus on is Chatswood, some nine kilometres to the west. The other notable transport hub is at Manly (about 10 kilometres away) which is the terminus for ferry services. Buses are the primary mode of non-car travel that services the Northern Beaches area.

Eleven bus routes operated by Sydney Buses and six bus routes operated by Forest Coach Lines operate within the Stage 2 Project area. The majority of buses travel towards Chatswood and Sydney CBD in the morning peak with the reverse occurring in the evening peak.

In 2012, prior to the Long Term Transport Master Plan and hospital proposal taking shape, a study was commissioned by Roads and Maritime into potential bus priority measures that might be pursued in the short term and medium term for the Warringah Road corridor. As part of these investigations, bus travel surveys were commissioned to identify the bus travel speed performance of services in this vicinity. The survey recorded travel times for Route 136 between Roseville and Dee Why, and Route 280 between Chatswood and Allambie Heights along the major direction of travel in the morning and evening peak periods.

The NSW targeted average speeds in operation at the time were 20–25 km/h over the length of the bus route. The target was not met for Route 280. This route, which runs along Warringah Road between Allambie Road and Forest Way, had travel speeds below the target and were much slower than the published timetable. Much of the delay was due to intersection congestion.

The bus travel surveys and analysis also identified slow points on the bus network by analysing GPS data collected from buses tracked through Roads and Maritime’s Public Transport and Priority System. Bottlenecks were noticeable in the Warringah Road corridor at:
- Warringah Road and Forest Way intersection
- Warringah Road and Starkey Street intersection (outside of the Stage 2 Project area).

3.2.4 Future road network performance

In addition to the need for adequate connectivity to the hospital in 2018, traffic volumes on the existing road network are forecast to increase as a result of background traffic growth and traffic growth associated with the hospital.

Increased levels of population and employment across the Northern Beaches are expected to result in increased background traffic volumes within the area of the Concept Proposal. In addition to the above background traffic growth, operation of the Northern Beaches Hospital is forecast to add about 900 vehicles in the evening peak hour (5pm to 6pm) which corresponds to the end of the day-time shift. The traffic generation of the hospital varies throughout the day, associated with the arrival and departure of patients, visitors and deliveries. Growth in light freight associated with medical-related development throughout the precinct is also anticipated.

Vehicular access to the hospital is proposed via Frenchs Forest Road West and Warringah Road. To facilitate access to the hospital, existing turning restrictions at some key intersections, currently necessary for traffic management reasons, are required to be removed. The traffic generation of the Northern Beaches Hospital and anticipated intensification of the surrounding...
employment areas (including the Frenchs Forest business park district) is forecast to significantly contribute to increased traffic congestion levels.

As a result of background traffic growth and the traffic generated by the Northern Beaches Hospital, traffic volumes in the three hour morning and evening peak periods are forecast to increase by 12 per cent and 11 per cent respectively between 2012 and 2018. By 2028, traffic volumes are forecast to increase by a further five per cent in the morning peak period and four per cent in the evening peak period.

As traffic volumes increase, congestion levels would also increase significantly, resulting in lower average travel speeds and an increase in the average delay per vehicle if no action is taken. In the evening peak period the average travel speed is predicted to reduce by up to 30 per cent between 2012 and 2018 (from 28 km/h to 20 km/h). By 2028 travel speeds are predicted to reduce by a further 16 per cent to around 17 km/h. The average delay per vehicle is predicted to increase by about 70 per cent to 2018 (from around 3.5 minutes to around six minutes) and by a further 30 per cent by 2028 (to almost eight minutes) if no action is taken.

An analysis of the existing conditions indicates that some intersections currently operate in oversaturated conditions and the predicted increase in traffic volumes would only increase the level of congestion. With regard to the average vehicle delay, the LoS for the intersection can be estimated based on the criteria presented in Table 3.1.

<table>
<thead>
<tr>
<th>Level of Service (LoS)</th>
<th>Average delay per vehicle (seconds/vehicle)</th>
<th>Traffic signals, Roundabout</th>
<th>Give way and Stop signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Less than 14</td>
<td>Good operation</td>
<td>Good operation</td>
</tr>
<tr>
<td>B</td>
<td>15 to 28</td>
<td>Good with acceptable delays and spare capacity</td>
<td>Acceptable delays and spare capacity</td>
</tr>
<tr>
<td>C</td>
<td>29 to 42</td>
<td>Satisfactory</td>
<td>Satisfactory, but accident study required</td>
</tr>
<tr>
<td>D</td>
<td>43 to 56</td>
<td>Near capacity</td>
<td>Near capacity, accident study required</td>
</tr>
<tr>
<td>E</td>
<td>57 to 70</td>
<td>At capacity, at signals incidents will cause excessive delays</td>
<td>At capacity, requires other control mode</td>
</tr>
<tr>
<td>F</td>
<td>Greater than 70</td>
<td>Extra capacity required</td>
<td>Extreme delay, major treatment required</td>
</tr>
</tbody>
</table>

*Source: Guide to Traffic Generating Developments, Roads and Maritime Services, 2002*

With regard to the performance of individual intersections, the majority of the signalised intersections within the study area are predicted to operate at LoS F in 2018, in either the morning or evening peak periods, in the absence of network enhancements.

The traffic modelling indicates that a considerable increase in network capacity would be required to maintain, let alone improve, existing service levels given critical intersections are currently operating at or over their effective capacity and that the proposed land use changes would exacerbate these conditions. In addition, traffic modelling suggests that traffic would be unable to enter the existing congested network, placing more pressure on local streets subject to the current ‘rat running’.
In addition to the need for road upgrades to provide connectivity to the new hospital, further capacity improvements would be needed on the surrounding network to address these issues.

### 3.3 Project objectives

The strategic aims of the Concept Proposal relate to provision of a road network solution that optimises connectivity of the existing road network surrounding the Northern Beaches Hospital at Frenchs Forest. At a wider level, the Concept Proposal and Stage 2 Project also aims to reinforce Warringah Road and Wakehurst Parkway as key arterial connections between the beachside suburbs of Sydney’s north, Chatswood and Sydney’s CBD.

Specific project objectives are:

- Improve peak period travel speeds and reliability on Warringah Road following the development of the Northern Beaches Hospital and the surrounding precinct
- Improve the network performance surrounding the Northern Beaches Hospital to support the development of the precinct
- Support the activation of the Northern Beaches Hospital Precinct by facilitating access connections to the hospital
- Allow for road based public transport along and across the corridor
- Maintain or improve road safety in accordance with current standards
- Minimise impacts on the environment
- Optimise the design to provide an urban design and landscape outcome that complements the surrounding environs.

### 3.4 Statement of strategic need

The Northern Beaches Hospital is the key component in the Northern Beaches Health Service Redevelopment project that involves a repositioning of the delivery of health services on the Northern Beaches to address contemporary and future needs of the local community. The hospital would be a Level 5 facility that would provide a greater range of health services and complex care within the local community, reducing the need to travel outside the Northern Beaches region.

The hospital site is strategically positioned both with regard to its location in the eastern half of the Northern Sydney Local Health District and within the Northern Beaches road transport network. However, there are existing constraints within the existing road network that would limit efficient access to the hospital. These include restrictions on certain turning movements at the intersections of Warringah Road and Wakehurst Parkway; and Frenchs Forest Road and Wakehurst Parkway. Removal of these restrictions without changes to the surrounding existing road network is not practicable as it would exacerbate already high levels of congestion that impact on traffic movement, particularly during peak travel periods.

The Long Term Transport Master Plan identifies Warringah Road as a key strategic transport corridor linking Dee Why and Chatswood. Heavy traffic flows and congestion along Warringah Road during commuter peak periods and, to a lesser degree, during business hours result in low average peak travel speeds, unreliable travel times and disruptions to traffic movements. This impacts both road users and the adjoining community. Warringah Road is already operating at
or beyond capacity during peak periods and is expected to experience continued traffic growth in the future.

Buses are the primary mode of non-car travel that service the Northern Beaches area with many routes running along the Warringah Road corridor. Existing levels of congestion affect the reliability of bus services and achievement of target operational speeds, and would expect to worsen with increased congestion. This would also constrain the introduction of bus priority initiatives such as Bus Rapid Transit within the corridor.

Based on the anticipated future land use changes associated with hospital development, the proposed development both within and surrounding the Northern Beaches Hospital Precinct under Warringah Council’s structure plan (currently being prepared by Warringah Council), future background growth as detailed in the North Sub Regional Strategy, and the current level of congestion on Warringah Road (a key strategic transport corridor linking Dee Why and Chatswood), the Concept Proposal (including its associated Stages) is needed at a strategic level to:

- Assist in the management of journeys in connection with anticipated future intensification of medical, commercial and residential land uses surrounding the new hospital
- Mitigate the worsening of traffic congestion on the Warringah Road and Wakehurst Parkway arterial road corridors and their principal feeder roads
- Enhance access arrangements by car, bus and active transport for the Northern Beaches Hospital employees, patients, outpatients and visitors
- Facilitate improved access to the Northern Beaches Hospital and the surrounding employment precincts
- Have key infrastructure components in place for the hospital opening in 2018.

Further justification for the Stage 2 Project is provided in Section 23. This includes consideration of the objectives of the EP&A Act, the principles of ecologically sustainable development and cumulative impacts.
4  Project development and alternatives

This section describes the various alternatives to the project that were considered as part of the project development process and explains how and why the project was selected as the preferred option. Design refinements for particular elements of the project are also addressed.

<table>
<thead>
<tr>
<th>Secretary’s Environmental Assessment Requirements</th>
<th>Where addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Environmental Impact Statement (EIS) must be prepared in accordance with, and meet the minimum requirements of, Part 3 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (the Regulation), including:</td>
<td>This EIS (including Certification) and Application for State Significant Infrastructure</td>
</tr>
<tr>
<td>1. The information required under clause 6 of Schedule 2 of the Regulation.</td>
<td>Section 4 (description and analysis of project alternatives and justification for selection of preferred option) and Section 23 (justification for the project, including taking into account the objects of the Environmental Planning and Assessment Act)</td>
</tr>
<tr>
<td>2. The content listed in clause 7 of Schedule 2 of the Regulation, including but not limited to: An analysis of feasible alternatives to the carrying out of the proposal and proposal justification, including:</td>
<td></td>
</tr>
<tr>
<td>• An analysis of alternatives/options considered having regard to the project objectives (including an assessment of the environmental costs and benefits of the proposal relative to the alternatives and the consequences of not carrying out the proposal), and whether or not the proposal is in the public interest, and</td>
<td></td>
</tr>
<tr>
<td>• Justification for the preferred proposal taking into consideration the objects of the Environmental Planning and Assessment Act 1979</td>
<td></td>
</tr>
<tr>
<td>The EIS must describe the consultation process and the issues raised, and identify where the design of the proposal has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.</td>
<td>Section 6.3 and Section 6.4 Appendix C</td>
</tr>
</tbody>
</table>

4.1  Background

Section 4 of the Northern Beaches Hospital Road Connectivity and Network Enhancement Project EIS (Roads and Maritime, 2014), which assessed the Concept Proposal and Stage 1 Project, described the strategic alternatives considered for the Concept Proposal and provided justification for the selection of a road-based transport solution that would best meet the project objectives.

Initially, it was envisaged that delivery of the project would occur as a single stage. However, development of the concept design for the hospital connectivity work (Stage 1 Project) progressed more quickly than for the wider network enhancement concept design. As a result it was decided to separate the project into two stages to allow flexibility in progressing the environmental assessment and application for planning approval.

The Stage 1 Project comprised essential road work providing connectivity to the hospital. The Stage 1 Project has been assessed in the EIS exhibited in October 2014 and was approved in June 2015. The Stage 2 Project comprises the network enhancement work to address the broader network capacity issues and is the subject of this EIS.

A detailed account of the development of options for both stages is provided in the Northern Beaches Hospital Road Connectivity and Network Enhancement Options Development and...
Alternatives considered

Four strategic alternatives to the Northern Beaches Hospital Road Connectivity and Network Enhancement Project (Concept Proposal), which includes both the Stage 1 Project and the Stage 2 Project, were considered and documented in the Northern Beaches Hospital Road Connectivity and Network Enhancement Project EIS, (Roads and Maritime, 2014). The strategic alternatives include:

- Alternative 1 – The base case or ‘do nothing/do minimum’
- Alternative 2 – Road based improvement options
- Alternative 3 – Investment to improve public transport
- Alternative 4 – Demand management.

These alternatives are described in Section 4.2.1 to Section 4.2.4. An evaluation of the alternatives is provided in Section 4.2.5.

4.2.1 Alternative 1 – The base case or ‘do nothing/do minimum’

The project area is located at the confluence of a number of major arterial routes, all heavily used during the morning and evening peaks. The ‘do minimum’ scenario included the Northern Beaches Hospital and provided the following minimal improvements to the network:

- Provision of a main hospital entrance on Frenchs Forest Road West, and a secondary left in left out entrance to the hospital from Warringah Road
- Provision of a right turn facility from Warringah Road westbound into Wakehurst Parkway northbound
- Provision of a right turn facility for Wakehurst Parkway southbound into Frenchs Forest Road West
- The upgrade of part of Frenchs Forest Road West to four lanes at the hospital main entrance, including right turn bays.

4.2.2 Alternative 2 – Road based improvement options

To support the hospital opening, consideration was given to road based improvements aimed at meeting the needs of the road network both in the Northern Beaches Hospital Precinct and across the regional road network.

Wider regional road network

Within the regional road network there are no adjacent or nearby parallel routes to Warringah Road that could be considered as a sufficient alternative to support access to the hospital. The closest alternatives that provide key arterial access routes to the Northern Beaches are Mona Vale Road and the Spit Road/Pittwater Road corridor. Upgrades to Mona Vale Road are currently being considered by Roads and Maritime and, while they would address traffic congestion on arterial road corridors and their principal feeder roads accessing the Northern Beaches, they would not address the specific access needs necessary to support the new hospital. The NSW
Government is also investigating options to improve the Military Road/Spit Road/Pittwater Road corridor, including considering potential tunnels and grade separation of intersections. As with Mona Vale Road, this would not address access to the new hospital.

**Northern Beaches Hospital road network**

Given there are limited road-based solutions in the regional network that support the opening of the Northern Beaches Hospital and meet the strategic aims of the Concept Proposal, several options within the Northern Beaches Hospital Precinct road network were further considered. The Northern Beaches Hospital Precinct road network is consistent with the existing road network described in Section 1.3 of this EIS. Options were developed to meet the strategic aims of the project, that is, to provide a road network solution that optimises connectivity of the road network surrounding the hospital, whilst also reinforcing Warringah Road and Wakehurst Parkway as key arterial connections between the beachside suburbs of Sydney’s north, Chatswood and Sydney’s CBD. Road based improvement options considered included measures to improve:

- Provide connectivity to the proposed Northern Beaches Hospital
- Road capacity (which notably includes Frenchs Forest Road, Wakehurst Parkway and Warringah Road) through:
  - widening roads on key routes
  - implementing parking restrictions on key routes
  - reallocating road space on key routes (bus and transit lanes).
- The operational efficiency of the arterial road network through:
  - grade separation of major intersections
  - implementing access controls
  - changing signal operation to increase priority for key routes
  - providing grade separation of major pedestrian crossings
  - installing right-turn bays at key intersections.

These alternatives would involve measures targeting both connectivity to the hospital and capacity and operation of the arterial road network.

**4.2.3 Alternative 3 – Investment to improve public transport**

Sydney’s Northern Beaches are currently not served by rail based public transport. The nearest railway station is located at Chatswood, around nine kilometres south west of the hospital site.

While there are currently no plans for a rail link to the Northern Beaches, the timeframe for developing, constructing and commissioning such a project would mean that it would not be operational in time to support the opening of the hospital or to address increasing congestion on the existing road network.

Options to enhance existing road based public transport services (i.e. buses) include:

- Improving strategic bus corridors
- Providing bus lanes on the local and arterial network.

Transport for NSW’s *Sydney’s Bus Future* proposes Warringah Road via Frenchs Forest Road as a suburban bus corridor with peak hour services every 10 minutes. Transport for NSW has
designated a minimum target speed of 18–25 km/h for the corridor between Chatswood and Manly via Dee Why/Brookvale.

A feasibility study (Transport for NSW, June 2012) has also investigated a number of corridor options for providing Bus Rapid Transit. Two corridors were investigated, being:

- A north-south corridor linking Mona Vale with the CBD via Military Road/Spit Road/ Pittwater Road
- An east-west corridor linking Dee Why and Chatswood via Warringah Road.

4.2.4 Alternative 4 – Demand management

Travel demand management is about modifying travel decisions and reducing dependence on travel by cars, especially during peak periods. Transport policies to encourage greater use of public transport within and across the Northern Beaches Hospital Precinct were considered as a possible alternative to the project. This could include:

- Limiting parking in the key areas including parts of Naree Road, Frenchs Forest Road West and Frenchs Forest Road East
- Changing land use policy to improve public transport access and reduce travel demand.

4.2.5 Evaluation of alternatives

Alternative 1 – The base case or ‘do nothing/do minimum’

Traffic modelling was carried out by Roads and Maritime on the ‘do minimum’ alternative assuming the Northern Beaches Hospital had commenced operation. The traffic model indicated that the average westbound morning peak travel speeds on Warringah Road between Wakehurst Parkway and Forest Way were estimated to decline from 24.6 km/h to 13.4 km/h between 2012 and 2021 under this scenario.

Modelled queuing distances evident during both the morning and evening peak periods from the Wakehurst Parkway and Warringah Road intersection, indicated that the provision of the right turn at Warringah Road was not feasible at grade. However, under conditions of grade separation provision of a right turn may be feasible. In addition, there would be seven intersections operating at LoS ‘F’ by 2021.

These figures show an inability of vehicles to enter the network due to congestion, indicating that accessibility generally throughout the region during peak hours would be diminished to unsustainable levels. Access to the hospital, and more broadly between Sydney’s North Subregion and the Sydney CBD (as well as other key destinations) would be severely diminished in the peak hours. Importantly, the provision of an improved rapid bus route between Mona Vale and the Sydney CBD and other services, as envisaged in Sydney’s Bus Future, would be severely impaired.

The base case alternative is not considered to be a viable alternative as it does not satisfy the fundamental objectives for the Concept Proposal (including the Stage 2 Project). That is, it would not support the activation of the Northern Beaches Hospital Precinct by facilitating access connections to the hospital, nor would it allow for improved road based public transport along and across the corridor as the existing road network would not accommodate the predicted growth in traffic. As a result, the ‘do minimum’ alternative was not considered further.
Alternative 2 – Road based improvement options

Regional road network

As discussed in Section 4.2.2, with other key arterial access routes to the Northern Beaches being Mona Vale Road and the Spit Road/Pittwater Road corridor, there are no adjacent or nearby parallel routes to Warringah Road that could be considered as an adequate alternative to support hospital access and to address capacity constraints on the Northern Beaches Hospital Precinct road network. Upgrades to Mona Vale Road are currently being considered by Roads and Maritime. The NSW Government is also investigating options to improve the Military Road/Spit Road/Pittwater Road corridor, including considering potential tunnels and grade separation of intersections. While these would address traffic congestion on arterial road corridors and their principal feeder roads accessing the Northern Beaches, they would not meet specific road capacity requirements necessary to cater for hospital related traffic, nor would they address capacity constraints within the Northern Beaches Hospital Precinct road network. Vehicles would still experience high levels of vehicle delay and poor intersection performance.

Given that there are limited road-based solutions in the regional network that support the opening of the Northern Beaches Hospital and meet the strategic aims of the project, several options within the Northern Beaches Hospital Precinct were further considered in the process of evaluating the effectiveness of a road based alternative in meeting the project objectives.

Northern Beaches Hospital Precinct road network

Larger scale road based improvements within the Northern Beaches Hospital Precinct road network were considered the most effective alternative in achieving access and network management functions necessary to meet the expectations of the Northern Beaches community.

At a strategic level, traffic modelling of the road based improvement options within the Northern Beaches Hospital Precinct suggests:

- Road based improvements would meet future traffic needs of the hospital and alleviate future congestion by providing improved capacity compared to 2021 ‘do minimum’ alternative
- By 2036, performance would have begun deteriorating back towards current levels. Improvements could be achieved through more efforts to shift travel demand towards active and public transport
- Average travel speeds and average vehicle delays would generally improve by 20 to 30 per cent in the critical westbound direction in the morning peak and the critical eastbound in the evening peak with the Concept Proposal (Stage 1 and Stage 2 Projects) in place in 2021 compared to current conditions, despite greater loading on the network through overall precinct development
- Substantial improvements in average delay would be realised at key intersections including:
  - Warringah Road and Wakehurst Parkway
  - Warringah Road and Forest Way
  - Wakehurst Parkway and Frenchs Forest Road.

A road based improvement alternative for the Northern Beaches Hospital Precinct road network best meet the project objectives by allowing for a road network that:

- Supports the activation of the Northern Beaches Hospital Precinct
- Addresses problematic major intersections to reduce detrimental upstream and downstream effects on the network
• Allows for road based public transport along and across the corridor
• Maintains or improves safety
• Minimises the impact on the environment by enhancing network performance through road improvements located largely within the existing road corridor
• Optimises urban design and landscape outcomes that complement the surroundings.

Alternative 3 – Investment to improve public transport

Improvements to bus transport are seen as complementary to the project by supporting, but not wholly able to address, the road user demands for the hospital and broader Northern Beaches area. Accordingly, a range of bus transport improvements have been included in the project where possible.

At present Sydney’s Northern Beaches are not served by rail based public transport. There are currently no plans for a rail link to the Northern Beaches; the timeframe for developing, constructing and commissioning such a project would mean that it would not be operational in time to support the opening of the hospital or to address increasing congestion on the existing road network.

The alternative to invest in improvements to public transport does not support the opening of the Northern Beaches Hospital or meet the strategic aims of the project.

Alternative 4 – Demand management

Improved land use planning integration and measures to minimise the need to travel are important medium to long-term initiatives, but alone were not considered to represent an adequate response to the more immediate strategic need of the Northern Beaches Hospital and proposed precinct development.

Demand management measures are seen as complementary initiatives rather than a viable stand-alone alternative to the project. To have a major impact on road traffic, demand management measures would also require major changes in social attitudes, travel behaviour and government policy.

The demand management alternative does not support the opening of the Northern Beaches Hospital or meet the strategic aims of the project.

4.2.6 Preferred strategic alternative

The road based improvements (within the Northern Beaches Hospital Precinct road network) alternative performed best against project objectives by:

• Supporting the activation of the Northern Beaches Hospital Precinct through facilitating access connections to the hospital
• Providing consideration to the anticipated future intensification of medical, commercial and residential land uses surrounding the hospital
• Mitigating the worsening of traffic congestion on the Warringah Road and Wakehurst Parkway arterial road corridors and their principal feeder roads
• Maximising the benefits to the local social environment
• Enabling the improvement to road safety in accordance with current standards.
The road based improvement alternative, including public transport elements, is considered to provide the best outcome for the local environment and community and is Roads and Maritimes’ preferred strategic alternative.

4.3 Options considered for the Stage 2 Project

The strategic aims of the Northern Beaches Hospital Road Connectivity and Network Enhancement Project (the Concept Proposal) relate to provision of a road network solution that optimises connectivity of the existing road network surrounding the Northern Beaches Hospital at Frenchs Forest (refer to Section 3.2.4). At a wider level, the Concept Proposal also aims to reinforce Warringah Road and Wakehurst Parkway as key arterial connections between the beachside suburbs of Sydney’s north and Chatswood and Sydney’s CBD.

To meet the strategic aims of the Concept Proposal, various options were considered as part of the road based improvement alternative within the Northern Beaches Hospital Precinct road network. While this EIS provides detail and assesses Stage 2 of the Concept Proposal (Stage 2 Project), the strategic options consideration for the Concept Proposal as a whole, forms the basis of the options development process of the Stage 2 Project. For project context, Section 4.2 reiterates options development for the Concept Proposal as described in the Northern Beaches Hospital Road Connectivity and Network Enhancement Project EIS (Roads and Maritime, 2014).

Option identification began with development of various minor work at primary intersections (Stage 1 Project options) before progressing into a network wide solution (Stage 2 Project options). Options considered fell into five broad groupings of work:

- Stage 1 options
  - Option 1 – Base case or ‘do nothing/do minimum’ (this is the same as alternative 1 described in Section 4.2.1 which has already been rejected)
  - Option 2 – Rudimentary hospital connectivity
  - Option 3 – Hospital Connectivity and minor network enhancements.

- Stage 2 options
  - Option 4 – Network enhancements through a grade separated underpass option (Warringah Road under Wakehurst Parkway, Hilmer Street and Forest Way)
  - Option 5 – Network enhancements through grade separated overpass option (Warringah Road over Wakehurst Parkway and Warringah Road under Forest Way).

Stage 1 Project options are considered and documented in the Northern Beaches Hospital Road Connectivity and Network Enhancements Project EIS (Roads and Maritime, 2014). Road-based improvement options relevant to the Stage 2 Project area are described below.

4.3.1 Network enhancements through grade separation underpass option

Warringah Road under Forest Way, Hilmer Street and Wakehurst Parkway

This option included an underpass on Warringah Road. The underpass option allows for travel lanes in each direction of through traffic to travel uninterrupted along the middle of the Warringah Road corridor at a sub-surface level. Surface roads would run parallel to the underpass as part of the Warringah Road corridor to provide access to local roads to the side and the hospital. The
underpass would go under the Wakehurst Parkway, Hilmer Street and Forest Way intersections allowing for through traffic to continue without stopping at traffic signals.

4.3.2 Network enhancements through grade separation overpass option

Warringah Road over Wakehurst Parkway and Warringah Road under Forest Way

The overpass option allows for travel lanes in each direction of through traffic to pass over Wakehurst Parkway and continue past the Hilmer Street intersection at grade (surface level). An underpass would also be required at the Forest Way intersection to provide continuous east-west flow of travel on Warringah Road. Surface roads would run parallel as part of Warringah Road to provide access to side roads and adjacent facilities.

4.3.3 Evaluation of strategic options

Options have been considered for both Stage 1 Project and Stage 2 Project in addressing the Concept Proposal's aims and objectives. Stage 1 Project option evaluation, as outlined in the Northern Beaches Hospital Road Connectivity and Network Enhancement Project EIS (Roads and Maritime, 2014), identified Option 3 as the preferred option for the Stage 1 Project.

The Stage 1 Project (Option 3) best met the project objective of supporting the activation of the Northern Beaches Hospital Precinct, through facilitating access connections to the hospital in 2018 and by ensuring the network travel speeds are similar to the existing speeds. However, traffic modelling indicated that the Stage 1 Project alone would not adequately support the forecast traffic demand much beyond opening of the hospital, and that in isolation, the Stage 1 Project is considered unacceptable in the longer term due to diminishing performance over time.

Consequently, the overall project objectives would not be met, as the reduction in network performance would unduly inhibit the ability of the network to cater for a viable road based public transport system along and across the corridor. To achieve long term network performance, it was recognised that Option 3 would need to be supported by major grade separations (such as underpass or overpass) at several key intersections along Warringah Road.

The Stage 2 Project options, grade separation via an underpass (Option 4) and grade separation via an overpass (Option 5), present network enhancement alternatives which, when considered in conjunction with the Stage 1 Project (Option 3), are aimed at addressing longer term network performance.

Preliminary traffic modelling carried out during the options development process involved traffic forecast assumptions containing a number of uncertainties. A conservative approach was taken to test that the grade separated options withstand potentially unforeseen high levels of demand.

Strategic evaluation of each grade separated option concluded broadly that, the underpass and overpass options are very similar in terms of traffic operation, each provide longer term network enhancements reducing potential for future redundancy, sacrificial work or future disruption. Excavation for the underpass option would produce considerable quantities of material which would require appropriate reuse or disposal. The underpass would, however, result in reduced noise and visual impacts when compared to the overpass. Both options were considered to be similar in ability to meet future bus priority targets for the corridor, similar in capital cost, and both options allow for staged construction of work while maintaining network capacity.
Notwithstanding the similarities in option outcomes, the underpass (Option 4) was considered to provide the best opportunity to meet the needs of the Northern Beaches Hospital and existing road network for the following reasons:

- Grade separation at Wakehurst Parkway, achieved through a depressed open-cut of Warringah Road, provides an interchange that is less visually intrusive
- It provides a clear road network structure, separating through and local traffic
- It provides signalised access from Warringah Road to and from the hospital, thus providing greater flexibility and network resilience
- It enables all existing movements at the intersection of Hilmer Street and Warringah Road to be maintained. Whereas Option 5 (overpass) would limit Hilmer Street to left in left out only and access to the hospital from Warringah Road to be left in left out only
- There is greater opportunity than with Option 5 (overpass) for connectivity of pedestrians and cyclists
- It provides greater flexibility in the long term should further augmentation of capacity be required, by allowing expansion of through traffic capacity by widening. An overpass is not considered readily expandable for through traffic.

Traffic modelling indicates Option 4 could provide for sufficient traffic operation in the longer term and reduce the potential need for additional work in the future. In addition, it should also have the ability to meet future bus priority targets for the corridor and allow for staged construction of work while maintaining network capacity.

The network performance of Option 5 is less than that of Option 4. This is in part due to the restricted access at Hilmer Street that Option 5 creates. Further, Option 5 enables only limited access to the hospital from Warringah Road. Option 5 has an increased visual impact and less potential to mitigate traffic noise when compared to Option 4. Therefore, Option 5 was not considered the preferred strategic option.

The evaluation process concluded that an underpass (Option 4) also provided a better opportunity to meet community expectations in terms of ease of local access and visual impact, and caters better for long term growth. Option 4 was considered to achieve satisfactory longer term network performance in 2036. It would reduce the potential need for additional work in the future, have the ability to meet future bus priority targets for the corridor and would better allow for the staged construction of work while maintaining network capacity.

Option 4 would also have the benefit of reducing visual impacts and have a greater potential to mitigate noise as a result of through traffic being in an underpass. Further, Option 4 would provide a clearer road network structure, would have less impact on future development by maintaining full access to Hilmer Street and provide for greater access for the hospital from Warringah Road.

4.3.4 Preferred strategic option

Option 4 (Stage 2 Project – Network Enhancement Work), when delivered in conjunction with Option 3 (Stage 1 Project – Hospital Connectivity Work), has been identified as the preferred option and deemed to be in the public interest by providing an integrated package of work across the existing road network.
The Stage 2 Project best meets the project objectives by:

- Improving peak period travel speeds and reliability on Warringah Road following the development of the Northern Beaches Hospital and the surrounding precinct
- Improving the network performance surrounding the Northern Beaches Hospital to support the development of the precinct
- Addressing problematic major intersections to reduce detrimental upstream and downstream effects on the network which is currently near capacity
- Allowing for road based public transport along and across the corridor
- Maintaining or improving safety by reducing potential for vehicle collisions by separating through traffic from traffic entering the hospital and existing road network
- Minimising the impact on the environment by catering for anticipated traffic growth in the precinct, mitigating noise impacts through design, and limiting the visual impact by providing an interchange that is more legible as opposed to intrusive
- Optimising urban design and landscape outcomes that complement the surroundings through greater urban permeability and connectivity of pedestrians and cyclists.

In this context, the Stage 2 Project, when delivered in conjunction with the Stage 1 Project, is the most logical approach to addressing the identified need for connectivity and network enhancement work in this location, both in terms of cost effectiveness and in achieving the most favourable environmental outcomes.

4.4 Development of Stage 2 Project options

4.4.1 Development and evaluation process

Development of Stage 2 Project options has involved industry participation. Around mid-2013, an industry review of the Stage 2 Project options (developed by Roads and Maritime) was carried out. In late 2013, Roads and Maritime engaged two engineering consultancies to provide an ‘industry challenge’ process whereby two overpass options and four underpass options were developed and tested. While the overpass option had previously been discounted, it was considered there would be value in a further, independent assessment of the benefits and disadvantages of this option.

At the same time that the ‘industry challenge’ process commenced, a third engineering consultancy was engaged as a technical reviewer, the intention of this being to further strengthen the robustness of the option development and evaluation process.

Evaluation criteria for the Stage 2 Project were developed within the context of both the specific project objectives (refer to Section 3.3) and broad desired outcomes. Mandatory criteria were required to be met for an option to proceed to further assessment otherwise it was discounted. These criteria comprised the following:

- The Stage 1 Project must be able to be completed prior to the hospital opening
- The Stage 2 Project option must provide a safe solution both during construction and operation
- The Stage 2 Project must maintain flexibility for further future upgrades, including road-based public transport.
In addition to the above mandatory criteria, the following specific criteria were adopted for the Stage 2 Project option evaluation process:

- Network performance
- Engineering design and constructability
- Environmental and community impacts
- Urban design and landscape
- Cost and economic return
- Delivery risk (i.e. time).

A total of 12 Stage 2 Project options (long list) were generated during the ‘industry challenge’ process including a range of overpass and underpass combinations:

- Option 1: comprising two sub-options 1A, 1B
- Option 2: comprising four sub-options 2A, 2B, 2C, 2D
- Option 3: comprising four sub-options 3A, 3B, 3C, 3D
- Option 4: comprising two sub-options 4A, 4B.

The Stage 2 Project sub-options were then subject to a design review, considering performance against project objectives and the evaluation criteria and this process eliminated eight leaving a short list of four options.

Stage 2 Project Options 1A, 2B, 3B and 4A were short listed and were taken forward for further consideration through a Value Management (VM) process to determine the preferred option. The functionality and general features of these four options are described in the following section.

### 4.4.2 Description of short-listed options

#### Stage 2 Project Option 1A

The functionality and general features of Option 1A are summarised as follows:

- Provision of an underpass (eastbound) on Warringah Road at the intersection of Forest Way
- Westbound through traffic to remain at-grade (surface lanes) at the intersection of Warringah Road and Forest Way
- Provision of an overpass on Warringah Road for eastbound and westbound through traffic at the intersection of Wakehurst Parkway
- Provision of left in left out only access on Warringah Road at Hilmer Street and at the hospital secondary access
- Provision of left out only from Fitzpatrick Avenue East to Wakehurst Parkway
- Provision of a new intersection at Wakehurst Parkway and Aquatic Drive to include left out (from Aquatic Drive to Wakehurst Parkway) and right in (from Wakehurst Parkway to Aquatic Drive) to improve local access.
Stage 2 Project Option 2B

The functionality and general features of Option 2B are summarised as follows:

- Provision of an underpass (centrally located) on Warringah Road, between west of Forest Way and east of Wakehurst Parkway, for separated eastbound and westbound through traffic.
- Widening of Warringah Road to provide surface roads on either side of the underpass for eastbound and westbound (non-through) traffic. Surface roads cater for all movements at key intersections.
- All points access at the intersection of Warringah Road, Hilmer Street and hospital secondary access.
- Provision of a new intersection at Wakehurst Parkway and Aquatic Drive to include left out (from Aquatic Drive to Wakehurst Parkway) and right in (from Wakehurst Parkway to Aquatic Drive) to improve local access.

Stage 2 Project Option 3B

The functionality and general features of Option 3B are summarised as follows:

- Provision of an underpass on the southern side of Warringah Road, between west of Forest Way and east of Wakehurst Parkway, for separated eastbound and westbound through traffic.
- Widening of Warringah Road to provide surface roads on the northern side of the underpass for eastbound and westbound (non-through) traffic. Surface roads cater for all movements at key intersections.
- All points access at the intersection of Warringah Road, Hilmer Street and hospital secondary access.
- Provision of a new intersection at Wakehurst Parkway and Aquatic Drive to include left out (from Aquatic Drive to Wakehurst Parkway) and right in (from Wakehurst Parkway to Aquatic Drive) to improve local access.

Stage 2 Project Option 4A

The functionality and general features of Option 4A are summarised as follows:

- Provision of an eastbound underpass on Warringah Road from west of Forest Way rising again to at-grade (surface lanes) west of Hilmer Street.
- Westbound traffic remains at-grade (surface lanes) on Warringah Road.
- Provision of left in left out only access on Warringah Road at Hilmer Street and at the hospital secondary access. Eastbound-westbound through traffic is not free flow at Hilmer Street and under traffic signal control.
- Provision of an underpass for separated right turn access from Warringah Road (eastbound) into Wakehurst Parkway (southbound).
- Warringah Road eastbound and westbound through traffic to remain at-grade (surface lanes) at the Wakehurst Parkway intersection (under traffic signal control).
- Provision of left out only from Fitzpatrick Avenue East to Wakehurst Parkway.
- Provision of a new intersection at Wakehurst Parkway and Aquatic Drive to include left out (from Aquatic Drive to Wakehurst Parkway) and right in (from Wakehurst Parkway to Aquatic Drive) to improve local access.
4.4.3 Analysis of short-listed options

The performances of the short-listed options were assessed against the project objectives by Roads and Maritime and key project stakeholders at the Value Management workshop held in May 2014 with reference to the evaluation criteria as outlined above. The evaluation of options was informed by preliminary environmental investigations, strategic traffic modelling and engineering design. The relative performance of each option is outlined below.

Option 1A was ranked third overall when assessed against the evaluation criteria. When compared to the other options, it was determined that Option 1A:

- Performed relatively poor against the network performance criteria. This was due to the reduced network speed from the grade of the overpass and the reduced access provision at the Hilmer Street intersection
- Was the lowest performing option against the environmental criteria due to a relatively large impact to Duffys Forest Endangered Ecological Community (EEC), traffic noise impacts from the overpass being greater than other options, and the extent of property acquisition being comparatively higher
- Performed relatively poor against the urban design and landscape criteria. This was partly due to the visual impact of the overpass compared to other options, and partly due to the landing of the overpass outside the hospital entrance on Warringah Road providing a reduced urban design and landscape outcome
- Was the best performing option against the value for money criteria and performed equally well with Options 2B and 4A in relation to engineering design and constructability criteria.

Option 2B was on balance the best performing option (ranked first) against the project objectives and selection criteria. When compared to the other options, it was determined that Option 2B:

- Was the best performing option when compared against the network performance criteria due to separating of east-west through traffic on Warringah Road and with key north-south intersections, and provision of full access at Hilmer Street
- Was the second best performing option when compared against the environmental criteria due to a relatively small impact to Duffys Forest EEC when compared to Options 1A and 3B, and having comparatively lower property acquisition impacts. Option 2B would result in traffic noise impacts due to surface roads moving closer to residential properties, however it performed comparatively better than Option 1A and 4A due to a greater proportion of through traffic using the underpass
- Performed the best against the urban design and landscape criteria due to its reduced visual impact and improved urban design outcome. The centrally located underpass improves legibility and provides improved connectivity for cyclist and pedestrians and integration with road based public transport with the surface roads on either side of the underpass
- Was the second best performing option against the value for money criteria and performed equally well with Options 1A and 4A in relation to engineering design and constructability criteria.

Option 3B was the second best performing option overall when compared against the project objectives and selection criteria. When compared to the other options, it was determined that Option 3B:
• Performed second best in terms of the network performance criteria. There were improvements in travel speed and average delay but the option did not perform as well as Option 2B due to the alignment of the underpass being less direct than for Option 2B

• Performed relatively poor against the environmental criteria (ranked third). It had the largest footprint and had the greatest impact to Duffys Forest EEC. It had a relatively large impact to property acquisition when compared to Options 2B and 4A. Option 3B had the lowest traffic noise impacts due to the westbound surface lanes on Warringah Road remaining in their current location and east-west through traffic using the underpass

• Performed relatively poor against the urban design and landscape criteria due to an asymmetrical alignment between the surface lanes and the lanes in the underpass. This would result in arrangement that is less legible for road users than Options 2B and 4A. The asymmetrical design would also make the integration of road based public transport with the surface roads (all on the northern side of the underpass) more difficult when compared to Option 2B (surface roads on either side of the underpass).

• Performed poorly against the value for money criteria. This was the best performing option in relation to engineering design and constructability criteria. This is because the underpass could be constructed ‘off line’ and to the south of the Warringah Road alignment, and could maintain the majority of the existing road pavement

Option 4A was the lowest performing option overall (ranked last) when assessed against the project objectives and selection criteria. When compared to the other options, it was determined that Option 4A:

• Was the lowest performing option for network performance as indicated by lower travel speeds and higher average delays for vehicles. The poor performance of this option is related to its inability to separate east-west through traffic along Warringah Road at the intersections with Hilmer Street and Wakehurst Parkway, with all traffic still required to stop at traffic signals (similar to the current arrangement)

• Was the second best performing option against the urban design and landscape criteria as it had a smaller visual impact than Options 1A and 3B (eastbound only underpass at Forest Way and a southbound slot from Warringah Road to Wakehurst Parkway southbound)

• Performed the best against the environmental criteria as the project footprint and the impacts to Duffys Forest EEC were the smallest and it impacted on the least number of properties. The option did perform comparatively poorer than Options 2B and 3B in terms of traffic noise impacts due to a greater proportion of traffic using the westbound surface lanes due to limited underpass features

• Performed poorly against the value for money criteria and performed equally well with Options 2B and 1A in relation to engineering design and constructability criteria.

4.4.4 Preferred Stage 2 Project option

Based on the relative performance of each option outlined above, Option 2B offered a better network performance solution over all other options, with urban design and landscape benefits also superior. Engineering design and constructability was considered to be similar for all options (Option 3B scoring slightly higher but not a measurable improvement over other options). Environmental and community impacts were similar between Options 2B and 4A, with both preferred over the other two short-listed options. Overall, Option 2B best meets the project
objectives and selection criteria and this recommendation was endorsed by the stakeholders at the value management workshop held in May 2014.

In consideration of all short-listed options across the evaluation criterion, the preferred option was determined to be Option 2B. The preferred option became the Stage 2 Project.

4.4.5 Network configuration review

Subsequent to the selection of Option 2B as the preferred Stage 2 Project option, a network configuration review was carried out of the strategic concept design, particularly in view of the number of surface road traffic lanes remaining unchanged with the addition of the four through traffic lanes. This considered key performance factors including road capacity, LoS and intersection performance in the context of traffic congestion within the network for two future year scenarios (2021 and 2036).

The analysis identified that the proposed lane configuration of the corridor would operate at a good LoS with ample capacity over its length. However, there would be areas of localised congestion that would experience a lower LoS associated with turning movements at intersections including:

- Left turn from Forest Way to Warringah Road
- Right turn from Wakehurst Parkway (southbound) to Warringah Road (westbound).

There would be sufficient capacity to enable buses to operate effectively in mixed traffic conditions along the Warringah Road surface road, without the need for indented bus bays or dedicated mid-block bus lanes. Buses would likely operate from the kerbside lanes with little detrimental impact on the movement of general traffic.

The review then considered a reduction in the capacity (in each direction) along the Warringah Road surface road between Forest Way and Wakehurst Parkway by reducing the surface road through lanes from three to two in each direction.

The analysis indicated that the road network under this configuration would function at a lower LoS and have localised capacity issues with congestion evident on Warringah Road between Wakehurst Parkway and Forest Way.

The network configuration review also suggested that, under a configuration of two lanes in each direction on the surface road, road-based public transport services operating in mixed traffic would be adversely affected by congestion. Operational speed targets would be unlikely to be met unless additional capacity was given to buses in terms of indented bus bays and dedicated bus lanes. However with only two lanes in each direction on the surface road in this scenario it would not be possible to dedicate a lane to buses as there would be a significant reduction in through capacity for general traffic causing major network congestion. Buses would also not operate efficiently in such congested mixed conditions from the kerbside lane or elsewhere without being impeded by general traffic.

The analysis also identified that the addition of an on ramp, from Wakehurst Parkway (southbound) into the Warringah Road underpass (westbound), would improve network performance by allowing southbound traffic on Wakehurst Parkway to join westbound through traffic along Warringah Road.

The review concluded that the proposed road system would operate at an appropriate LoS and provide an efficient road system for road users into the future with the Stage 2 Project. Any reduction in lane configuration along Warringah Road (e.g. to reduce footprint or to dedicate a
lane for bus priority) would result in higher congestion and a lower LoS that would deteriorate over time. It would also reduce the effectiveness of the road upgrade and be incapable of accommodating the projected increase in traffic.

The proposed road system could accommodate kerbside bus stops without a requirement for bus indents and buses could operate satisfactorily from the kerb side lane provided three lanes in each direction were provided on the Warringah Road surface lanes. The analysis also indicated that removing a lane on the surface road (from three to two lanes e.g. to reduce footprint or to dedicate a lane for bus priority) would cause localised and wider network congestion, therefore justifying the need for three lanes for general traffic use. The review confirmed that the proposed configuration of the Stage 2 Project would be the most effective means of managing future traffic needs and facilitating efficient road network performance across the Northern Beaches Hospital Precinct.

4.4.6 Alternative alignment investigations

The community consultation carried out from July to August 2014 included engagement with affected businesses on the southern side of Warringah Road generally between Bantry Bay Road and Hilmer Street. Following feedback, Roads and Maritime investigated a further three options for the preferred Stage 2 option. These included a tunnel using two different construction methods, and an underpass with widening on the northern side of Warringah Road.

These design investigations were carried out in collaboration with Transport for NSW, Health Infrastructure and the Department of Education and Communities, and included an assessment of cost and impacts on local properties, businesses, The Forest High School and the new hospital.

Consideration of the alternative alignment options is provided in the Northern Beaches Hospital Road Connectivity and Network Enhancement Options Development and Selection Report (Roads and Maritime, 2014).

The alternative alignments were reviewed against the project objectives and evaluation criteria. The review confirmed that both of the tunnel options would provide better network performance than the preferred option, commensurate with the additional cost. Key disadvantages of both tunnel options include longer construction periods and greater operational cost when compared to the preferred option. While widening to the north of Warringah Road would avoid impacts to the businesses on the southern side of Warringah Road, it would have a number of unavoidable impacts, particular on future use of the hospital site and The Forest High School.

4.5 The project

On balance, the underpass alignment (Option 2B) is considered to best meet the project objectives and is confirmed as the preferred option for the Stage 2 Project.

The Stage 2 Project broadly includes:

- Connectivity to the hospital through the provision of direct secondary access to the hospital site from Warringah Road, and existing road network enhancements to manage the network’s capacity for through traffic and traffic accessing the hospital
- Widening and upgrades along Warringah Road to increase capacity and to enable through traffic to avoid signalised intersections at Forest Way, Hilmer Street and Wakehurst Parkway. This would involve work to achieve grade separation (underpass) at these intersections
- Widening and intersection upgrades along sections of Forest Way, Wakehurst Parkway (south), Allambie Road (south), Warringah Road and Aquatic Drive
- Consideration of existing road based public transport infrastructure, provisions for suitable capacity to cater for road based public transport
- The Stage 2 Project is largely located with the existing road corridors however some property acquisition will be required.

A full description of the Stage 2 Project is provided in Section 5.
5  Project description

This Section describes the proposed scope of work, including the route alignment, corridor width, main project elements, ancillary facilities, design standards and construction activities.

<table>
<thead>
<tr>
<th>Secretary’s Environmental Assessment Requirements</th>
<th>Where addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Environmental Impact Statement (EIS) must be prepared in accordance with, and meet the minimum requirements of, Part 3 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (the Regulation), including:</td>
<td>Section 5 (project description), and Section 7 (Traffic and Transport)</td>
</tr>
<tr>
<td>• a detailed description of the proposal, including:</td>
<td></td>
</tr>
<tr>
<td>- design of road upgrade work, including road widening, intersection treatment and grade separation work, property access, pedestrian and cyclist facilities (including appropriate location for overbridges) and public transport facilities;</td>
<td></td>
</tr>
<tr>
<td>- land use changes, including resumption of residential, commercial and/or industrial lands, and impacts to Council and Crown land;</td>
<td></td>
</tr>
<tr>
<td>- location and operational requirements of construction ancillary facilities and access; and</td>
<td></td>
</tr>
<tr>
<td>- relationship and/or interaction with existing public and freight transport services (including bus traffic and bus stops).</td>
<td></td>
</tr>
<tr>
<td>• details of the proposal’s relationship to and consistency with the Concept Proposal and Stage 1 application;</td>
<td>Section 1.1</td>
</tr>
</tbody>
</table>

5.1  The Project

This section and Section 5.2 provide a detailed description of the Stage 2 Project and design elements, with construction methods and construction staging described in Section 5.3 and Section 5.4. An overview of the project is provided in Section 1.2. The description of the project provided in this section is based on the concept design and addresses the constraints and principles identified during the Stage 1 and Concept Proposal EIS and describes the key elements of the project – such as the surface and sub-surface work.

The concept design is intended to define a buildable concept that provides:

• A definition of property acquisition requirements sufficient to allow acquisition to proceed
• A clear description of the design principles, extent of impacts and impact management requirements
• A sound and clear basis for later development of the detailed design to a standard required to support project delivery.

The design of the Stage 2 Project would continue to be refined during the detailed design phase and would be guided by the key principles developed during the concept design and EIS phase. Sufficient flexibility has been provided in the Stage 2 Project concept design to allow for refinement during detailed design and to allow for refinement in response to any submissions received following the exhibition of this EIS or to minimise environmental impacts. The development of the detailed design would:
• Be consistent with key design parameters as described in this EIS and any subsequent response to submissions or preferred infrastructure report
• Address any unresolved issues associated with the development of the concept design proposed in this EIS and any subsequent response to submissions or preferred infrastructure report
• Meet any conditions of approval arising from the approval process under Part 5.1 of the EP&A Act
• Avoid identified environmentally sensitive areas and significant species and communities wherever possible
• Further develop and refine mitigation measures
• Appropriately develop and incorporate the urban design and landscape strategy
• Establish detailed proposals for construction delivery method, addressing buildability, traffic capacity and safety during construction, geotechnical issues, all relevant Roads and Maritime specifications and design requirements, current guidelines and policies, and practicality/cost effectiveness
• Address risk management during construction and operation
• Ensure that the detailed design allows for safe and cost-effective maintenance of the project during operation in accordance with work health and safety requirements and relevant Roads and Maritime specifications.

5.1.1 Project footprint

In consideration of the specific project objectives, the concept design process for the Stage 2 Project incorporated considerable design refinements to ensure network enhancement objectives were achieved whilst minimising environmental impacts, such as land acquisition and vegetation removal.

The distance at the greatest width of the Stage 2 Project concept design is about 100 metres. The project is incorporated largely within the existing road reserve to the north, and extends south beyond the existing road reserve by up to about 40 metres along Warringah Road.

The Stage 2 Project is proposed to be carried out generally along Warringah Road from west of Fitzpatrick Avenue East to west of Allambie Road, Forest Way between Warringah Road and the Stage 1 tie in (about 170 metres north of the Warringah Road intersection), Wakehurst Parkway between the Warringah Road intersection and 150 metres south of Aquatic Drive, Aquatic Drive for about 150 metres east of Wakehurst Parkway, and Allambie Road between Warringah Road and Rodborough Road.

5.1.2 Project description – sub-surface work

In addition the surface road upgrades described in Section 5.1.3, the project would provide a two-way four-lane divided road (two lanes in each direction) within an open sub-surface slot to provide additional capacity, and cater for east-west through traffic along Warringah Road by avoiding signalised surface intersections at Forest Way, Hilmer Street and Wakehurst Parkway.

The Warringah Road slot would tie into the existing six-lane surface road at Fitzpatrick Avenue East (western access point) and about 350 metres east of the Wakehurst Parkway intersection (eastern access point). A two-lane on-ramp (merging into one lane) would be provided at
Wakehurst Parkway (southbound) into the slot (westbound) (refer to Section 5.1.13). No access or egress at other locations would be provided to, or within, the slot.

Generally the sub-surface elements are exposed (open slot) with the exception of the grade separated intersections of Forest Way, Hilmer Street and Wakehurst Parkway, which are around 30 metre to 60 metre covered bridge sections of variable width, to allow a range of surface traffic movements. The lengths of open and covered sections (from east to west) of the Stage 2 Project are identified in Table 5.1 and illustrated in Figure 5.1 to Figure 5.4.

Table 5.1 Lengths of open and covered Slot sections

<table>
<thead>
<tr>
<th>Location</th>
<th>Section covered/uncovered</th>
<th>Length of section (indicative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Fitzpatrick Avenue East to the Forest Way grade separated intersection</td>
<td>Uncovered</td>
<td>240 metres</td>
</tr>
<tr>
<td>Forest Way grade separated intersection</td>
<td>Covered</td>
<td>30-60 metres of cover</td>
</tr>
<tr>
<td>Between the Forest Way grade separated intersection to the Hilmer Street grade separated intersection</td>
<td>Uncovered</td>
<td>450 metres</td>
</tr>
<tr>
<td>Hilmer Street grade separated intersection</td>
<td>Covered</td>
<td>50 metres of cover</td>
</tr>
<tr>
<td>Between the Hilmer Street grade separated intersection to the Wakehurst Parkway grade separated intersection</td>
<td>Uncovered</td>
<td>190 metres</td>
</tr>
<tr>
<td>Wakehurst Parkway grade separated intersection</td>
<td>Covered</td>
<td>60 metres of cover</td>
</tr>
<tr>
<td>Between the Wakehurst Parkway grade separated intersection to about 350 metres east of Wakehurst Parkway</td>
<td>Uncovered</td>
<td>350 metres</td>
</tr>
</tbody>
</table>

The Stage 2 Project would accommodate the following key sub-surface project elements (subject to detailed design) on Warringah Road (as illustrated in Figure 5.1 to Figure 5.4):

- Provision of four through lanes (two lanes in each direction) within an open slot for about 1.3 kilometres
- Ingress and egress points from and to the slot include:
  - Warringah Road near Fitzpatrick Avenue East
  - Warringah Road from about 350 metres east of the Wakehurst Parkway grade separated intersection
  - Provision of a two-lane on-ramp (merging into one lane) from Wakehurst Parkway (southbound) into the slot (westbound).
- Depth from the surface road to the slot road level generally varies between zero to eight metres
- A minimum clearance of 5.5 metres under covered bridge sections at Forest Way, Hilmer Street and Wakehurst Parkway grade separated intersections
- A centrally located concrete median of variable width would be provided for the length of the project, including a concrete safety barrier for the full length of the sub-surface road. The centrally located concrete barrier median would extend between Fitzpatrick Avenue East and the Stage 1 tie in (about 120 metres west of Allambie Road)
- Two breakdown bays would be provided in the slot between Forest Way and Hilmer Street, one eastbound bay and one westbound bay
- Median breaks in the slot west of Forest Way and east of Wakehurst Parkway would be provided as emergency cross overs for the purposes of incident management
- Provision of 0.5 metre shoulders in the slot and kerb and gutter on surface roads
- Posted speed limit of 70 km/h.
Break down bay in underpass

New shared pedestrian and cycle bridge

Warringah Road widened to the south to provide two through lanes in each direction in the underpass and three lanes at the surface in each direction for access to the local road network

Westbound ramp entry to underpass from surface (traffic travelling south from Wakehurst Parkway)

Widening of Allambie intersection with

Easting ingress/egress point

Intersection remains at surface with underpass extending beneath

Stage 1 works

Retaining wall

Variable message sign (VMS)

Upgrade area

Bus facility / bus lane

New hospital site

Shared path

Footpath

Median

Replacement of underpass

Daily average traffic volume (VAD) at major intersections

New co-connection to/from underpass for through traffic

Variable message sign (VMS) and cycle bridge

Bus facility / bus lane

Variable message sign (VMS)

Upgrade area

Footway

Ramp into underpass

Shared pedestrian and cycle bridge

Retaining wall

Bus facility / bus lane

Variable message sign (VMS)
Intersection remains at surface with underpass extending beneath
Widen Wakehurst Parkway to two lanes each direction
New connection to/from Aquatic Drive
Retain existing pedestrian bridge

Key
- Upgrade area
- New hospital site
- Median
- Footpath
- Shared path
- Underpass
- Ramp into underpass
- Shared pedestrian and cycle bridge
- Retaining wall
- Stage 1 works
- Noise barriers
- Bus facility / bus lane
- Variable message sign (VMS)
Widening of Allambie Road and upgrade to the intersection with Warringah Road.

**Key**
- Upgrade area
- New hospital site
- Median
- Footpath
- Shared path
- Underpass
- Ramp into underpass
- Shared pedestrian and cycle bridge
- Bus facility / bus lane
- Retaining wall
- Stage 1 works
- Noise barriers
- Variable message sign (VMS)
5.1.3 Project description – surface work

The Stage 2 Project would broadly include the following key project elements (subject to detailed design):

- Widening of Warringah Road from west of Fitzpatrick Avenue East to west of Allambie Road to include:
  - Westbound travel lanes, at surface level on the southern side of the Warringah Road corridor for the length of the project
  - Eastbound travel lanes, at surface level on the northern side of the Warringah Road corridor (using existing road pavement), for the length of the project.

- Construction of surface level bridges over the slot at intersections of Warringah Road with Forest Way, Hilmer Street and Wakehurst Parkway to provide traffic movements at surface level and allow uninterrupted east-west through traffic in the slot.

- Upgrades or adjustments to existing intersections of Warringah Road with the following local roads and approaches:
  - Fitzpatrick Avenue East (including the closing of the left turn into Fitzpatrick Avenue East from Warringah Road westbound)
  - Rodborough Road
  - Allambie Road.

- Widening of Wakehurst Parkway from the intersection of Warringah Road to south of Aquatic Drive.

- Provision of a new connection at Aquatic Drive including right in from Wakehurst Parkway (northbound), left in from Wakehurst Parkway (southbound) and left out from Aquatic Drive onto Wakehurst Parkway (southbound).

- Provision of shared pedestrian and cyclist bridges at the following locations:
  - Across Warringah Road west of the intersection of Forest Way (removal and replacement of the existing pedestrian bridge)
  - Across Warringah Road on the western side of the intersection with Hilmer Street (new shared pedestrian and cyclist bridge).

- Shared paths and footpaths on sections of Warringah Road, Wakehurst Parkway, Forest Way, Aquatic Drive and Allambie Road.

A detailed description of the key project surface elements is provided below and illustrated in Figure 5.1 to Figure 5.4. Figure 5.5 to Figure 5.7 provide photomontages showing indicative images of the key locations along the alignment. These photomontages are indicative only and may change during detailed design.

Warringah Road

As described in Section 5.1.2, to increase capacity and to enable through traffic to avoid signalised intersections at Forest Way, Hilmer Street and Wakehurst Parkway, widening is proposed to accommodate four subsurface, grade separated, east-west through traffic lanes (two lanes in each direction) centrally located between the proposed surface road elements.
Surface roads would run parallel to the underpass as part of the Warringah Road corridor to provide access to adjoining roads and to the hospital. Key surface road elements, described as sections between each of the three grade separated intersections at Forest Way, Hilmer Street and Wakehurst Parkway (described in detail below), is provided here (refer to Figure 5.1 to Figure 5.4):

- **Fitzpatrick Avenue East to Forest Way**
  - **Eastbound**
  - Provision of two to three through lanes.
  - **Westbound**
  - Provision of four through lanes with a staggered merge to two surface lanes where surface traffic merges with slot traffic (about 80 metres west of Fitzpatrick Avenue East).
  - Merge single surface lane and two slot lanes to tie into the existing three lanes at the Project tie in (end of Project) at Maxwell Road.
  - Reconfiguration of Fitzpatrick Avenue East intersection from left in left out, to left out only.

- **Forest Way to Hilmer Street**
  - **Eastbound**
  - Retain existing uncontrolled left turn merge from Forest Way to Warringah Road (eastbound).
  - Provision of three through lanes from about 160 metres east of Forest Way.
  - **Westbound**
  - Provision of three through lanes reducing to two lanes where the right turn lane into Forest Way commences.
  - Provision of three dedicated right turn lanes from Warringah Road to Forest Way (northbound).

- **Hilmer Street to Wakehurst Parkway**
  - **Eastbound**
  - Retain existing configuration of three through lanes, one left turn and two right turn lanes at the Wakehurst Parkway intersection.
  - **Westbound**
  - Provision of three through lanes.
  - Provision of left in left out only to Bantry Bay Road.

- **Wakehurst Parkway to Allambie Road**
  - **Eastbound**
  - Maintain existing three lane configuration between Wakehurst Parkway to the merge with slot traffic, about 300 metres east of the Wakehurst Parkway intersection.
  - About 300 metres east of the Wakehurst Parkway intersection, surface and slot traffic would merge from five lanes to four lanes (three surface lanes merging with two lanes of slot traffic).
Between the location where surface and slot traffic merge and Allambie Road (north), the kerbside surface lane transitions to a shared through and left turn lane, ending at Allambie Road (shared through and left turn lane provided as part of the Stage 1 Project).

Two right turn lanes (eastbound) are provided into Allambie Road (southbound).

Retain the existing three lane configuration east of the Allambie Road intersection.

**Westbound**

Three existing through lanes open to four lanes from about 350 east of the Wakehurst Parkway grade separated intersection (underpass entrance). Two lanes would proceed into the slot, and two surface road lanes would be provided toward the Wakehurst Parkway intersection. The two surface lanes would open to three lanes at the intersection approach (see below).

Maintain existing unsignalised left out configuration to Rodborough Road from Warringah Road.

**Warringah Road and Forest Way intersection**

Key project elements proposed at the Warringah Road and Forest Way grade separated intersection (subject to detailed design) are illustrated in Figure 5.1 and include:

- **Warringah Road**
  
  **Eastbound**
  
  - Provision two through lanes will be provided, with the adjacent short kerb side (currently chevron line marked) would be retained and may provide an additional lane should this be needed in the future.
  
  - Two signalised dedicated left turn lanes to Forest Way.
  
  - One existing one-way service road (for buses) from Warringah Road to Forest Way (outside Frenchs Forest Public School) would be maintained.
  
  **Westbound**
  
  - Provision of two through lanes.
  
  - Provision of three dedicated right turn lanes to Forest Way (northbound).

- **Forest Way**
  
  - Extension of the existing (southbound) bus bay, north of Rabbett Street, to accommodate two buses.
  
  - Maintain existing single uncontrolled left turn slip lane to Warringah Road (eastbound).
  
  - Two general traffic right turn lanes to Warringah Road (westbound). The left side lane would also act as a shared right and left turn lane to Warringah Road (eastbound).
  
  - Retain existing bus priority lane to Warringah Road (westbound). The dedicated bus lane then merges with surface through traffic on Warringah Road (westbound).
  
  - Bus priority measures would allow buses to exit from Forest Way in advance of general traffic.

A photomontage showing an indicative view looking towards the Warringah Road and Forest Way intersection (to the north) is presented in Figure 5.5, from around the location of Fitzpatrick.
Avenue. Figure 5.6 presents an indicative photomontage looking east from the Warringah Road and Forest Way intersection (view from the pedestrian bridge).

**Figure 5.5** Photomontage – Eastbound approach Warringah Road and Forest Way. intersection with underpass entry

**Figure 5.6** Photomontage – Warringah Road and Forest Way intersection looking east
Warringah Road, secondary hospital access and Hilmer Street

The Stage 1 Project provides for a left in left out arrangement as a secondary access to the hospital on Warringah Road. The Stage 2 Project would also provide a right turn lane onto Warringah Road (westbound) from the hospital site. Through access from Hilmer Street to the secondary hospital access and vice versa would not be permitted. In addition, the grade separated intersection at Hilmer Street would enable all existing movements at the intersection of Hilmer Street and Warringah Road to be maintained.

Key project elements proposed at the Warringah Road, secondary hospital access and Hilmer Street grade separated intersection (subject to detailed design) are illustrated in Figure 5.2 and include:

- **Warringah Road**
  - *Eastbound*
  - Provision of three surface road through lanes (eastbound) on Warringah Road.
  - *Westbound*
  - Provision of three surface road through lanes (westbound) on Warringah Road
  - Provision for a right turn lane onto Warringah Road (westbound) from the hospital site.
- **Hilmer Street**
  - Retention of all existing movements to and from Hilmer Street including:
    - Right turn from Warringah Road (eastbound) to Hilmer Street
    - Left turn from Warringah Road (westbound) to Hilmer Street
    - Left turn from Hilmer Street to Warringah Road westbound
    - Right turn from Hilmer Street to Warringah Road eastbound.

Wakehurst Parkway and Warringah Road intersection

Key project elements proposed at the Wakehurst Parkway and Warringah Road grade separated intersection (subject to detailed design) are illustrated in Figure 5.3 and include:

- **Warringah Road**
  - *Eastbound*
    - Maintain existing three through lanes, to the north of the slot
    - Maintain existing dedicated left turn lane to Wakehurst Parkway (northbound)
    - Maintain existing two dedicated right turn lanes to Wakehurst Parkway (southbound).
  - *Westbound*
    - Provision of three through lanes, to the south of the slot
    - Provision of one Bus only (priority) through lane (westbound)
    - Provision of one dedicated left turn lane into Wakehurst Parkway (southbound).
Wakehurst Parkway

**Southbound**
- Maintain existing dedicated left turn lane to Warringah Road (eastbound)
- Maintain existing dedicated dual right turn lanes to Warringah Road (westbound)
- Maintain existing Bus only through lane
- Maintain existing general traffic through lane
- The existing shared through/dual right turn lanes would be upgraded to accommodate:
  - two on ramp lanes with a staggered merge (from two to one) into the slot (westbound)
  - one dedicated right turn lane to surface road (westbound).

**Northbound**
- Provision of two through lanes
- Provision of two right turn lanes to Warringah Road (eastbound)
- Provision of two dedicated left turn lanes into Warringah Road (westbound).

A photomontage showing an indicative view looking west towards the Warringah Road and Wakehurst Parkway intersection (approaching from the east) is presented in Figure 5.7. This figure also shows the approach to the underpass.

*Figure 5.7 Photomontage – Eastern approach (looking west) along Warringah Road and Wakehurst Parkway intersection and entrance to underpass*
Wakehurst Parkway and Aquatic Drive

Key project elements proposed at the Wakehurst Parkway and Aquatic Drive intersection (subject to detailed design) are illustrated in Figure 5.3 and include:

- Provision of a new unsignalised left in left out connection to Aquatic Drive from Wakehurst Parkway (southbound)
- Provision of a new unsignalised dedicated right turn lane to Aquatic Drive from Wakehurst Parkway (northbound).

A photomontage showing an indicative view looking towards the Wakehurst Parkway and Aquatic Drive intersection (looking south) is presented in Figure 5.8.

Figure 5.8 Photomontage – Northern approach (looking south) to Wakehurst Parkway and Aquatic Drive intersection
Allambie Road and Warringah Road intersection

To provide local network enhancements for traffic entering the Allambie Road/Aquatic Drive business precinct, upgrades have been proposed under the Stage 1 Project for all approaches to the Allambie Road and Warringah Road intersection with the exclusion of the Allambie Road (south) approach.

Key Stage 2 Project elements proposed at the Allambie Road and Warringah Road intersection (subject to detailed design) are illustrated in Figure 5.4 and include:

- **Allambie Road (south):**
  - Provision of two through lanes to Allambie Road (north)
  - Provision of one right turn lane into Warringah Road (eastbound)
  - Provision of two southbound lanes.

- **Warringah (eastbound):**
  - Provision of two dedicated right turn lanes from Warringah Road (eastbound) to Allambie Road (south).

5.1.4 Provisions for pedestrians and cyclists

Statistics for the Forest District indicate the mode share for active transport (walking and cycling) is relatively low, between two per cent and four per cent of Journey to Work trips (ABS, 2006 Census). There are more or less continuous footpaths for roads in the study area. Signalised pedestrian crossings are provided on the Warringah Road and Wakehurst Parkway intersection. There are no existing formal bicycle routes immediately adjacent to the hospital site.

Although the ability to improve the active transport catchment potential of the Northern Beaches Hospital Precinct largely depends on the wider intensified redevelopment of the area, some active transport access improvements have been integrated into the Stage 2 Project, to support a shift to active transport modes. Active transport access improvements would be designed in consideration of the existing and proposed bicycle route network in the Warringah Council Bike Plan (Warringah Council, 2010).

Provision of pedestrian facilities would improve connectivity and provide safe crossing locations on Warringah Road, Forest Way, Wakehurst Parkway, and Allambie Road. The Stage 1 project would improve pedestrian and cyclist connectivity which would be further enhanced by the Stage 2 Project.

There are limited bicycle facilities on, or traversing, the existing road network of the Stage 2 Project. The Warringah Bike Plan (Warringah Council, 2010) identifies on-road bicycle routes along Wakehurst Parkway for the length of the project area and a small section traversing the project from Rabbett Street linking to the shared path joining Karingal Crescent. At the time of writing the EIS, no off-road bicycle routes are provided within the Stage 2 Project area, however, proposed off-road bicycle routes have been identified by Council to be located along Warringah Road, Forest Way, Aquatic Drive and Allambie Road (south of Warringah Road).

As part of Stage 2 Project detailed design, Roads and Maritime would provide shared paths (being off-road cycleway and pedestrian footpath) aiming to facilitate connection with the existing or proposed cycleways indicated on the Warringah Bike Plan and as part of the Stage 1 Project.
Stage 2 Project pedestrian and cyclist facilities include:

- Provision of new three metre wide shared paths within footpath reservations generally of 3.5 metres wide at the following locations:
  - Southern side of Warringah Road from Fitzpatrick Avenue East to Allambie Road
  - Northern side of Warringah Road from Forest Way to Wakehurst Parkway.

- Provision of new 2.5 metre wide shared paths within footpath reservations generally of 3.5 metres wide at the following locations:
  - Eastern side of Wakehurst Parkway from Warringah Road to Aquatic Drive
  - Eastern side of Forest Way from the intersection with Warringah Road to the Stage 1 Project tie in (about 170 metres north of the intersection)
  - Allambie Road between Warringah Road and Rodborough Road.

- Provision of a new 1.5 metre pedestrian path within footpath reservation at:
  - Northern side of Warringah Road between Wakehurst Parkway and Allambie Road
  - Northern side of Aquatic Drive between Wakehurst Parkway and project tie in (about 150 metres east of the new intersection)
  - Western side of Forest Way between Warringah Road and Stage 1 Project tie in (about 170 metres north of the intersection).

- Provision of shared pedestrian and cyclist bridges at the following locations:
  - Removal and replacement of the existing pedestrian bridge across Warringah Road, about 45 metres west of the intersection of Forest Way
  - An existing surface crossing would be removed and replaced with a new shared pedestrian and cyclist bridge across Warringah Road, on the western side of the intersection with Hilmer Street.

- Adjustments to the signalised pedestrian crossing facilities on Allambie Road (south) at the intersection with Warringah Road to accommodate the widening of Allambie Road (south).

- Existing pedestrian crossing facilities would be reconfigured at the following signalised intersections:
  - Existing pedestrian crossing on Warringah Road (eastern side of the intersection with Wakehurst Parkway) would be reconfigured as part of grade separation work
  - Existing pedestrian crossing on Forest Way intersection with Warringah Road would be reconfigured.

The existing pedestrian bridge over Wakehurst Parkway south of Allambie would be retained. Indicative dimensions of the shared pedestrian and cyclist bridges are presented in the cross section figures in Section 5.2.2 (Figure 5.11 and Figure 5.12).

Where cycleways are provided as part of a shared path network, traffic signals would be modified to incorporate bicycle lanterns.
5.1.5 Provisions for public transport facilities

There is no rail service on the Northern Beaches and the closest railway station that bus services focus on is Chatswood, some nine kilometres to the west of the project. The other notable transport hub is at Manly, some 10 kilometres to the east of the project, which is the terminus for ferry services. Buses are the primary mode of public transport that service the area. Currently there are 11 bus routes operated by Sydney Buses and six bus routes operated by Forest Coach Lines within the Stage 2 Project area.

The majority of bus services travel towards Chatswood and Sydney CBD in the morning peak with the reverse occurring in the evening peak. In the east-west direction, services are split between Warringah Road and Frenchs Forest Road.

East of the Stage 2 Project area, the services are split between the destinations of Brookvale and Dee Why. To the west, services diverge from Warringah Road at Forest Way, either towards Belrose or to the east via Frenchs Forest Road.

The locations of existing bus stops (including school bus stops) across the existing bus network in Frenchs Forest are illustrated in Figure 5.9.

As part of the proposed increases in public transport across the Northern Beaches, Transport for NSW is proposing to modify the bus routes within the Northern Beaches Hospital Precinct and provide more frequent services in the morning and evening peak periods. While final bus stop locations within the precinct are yet to be determined by Transport for NSW, Roads and Maritime would continue to consult with Transport for NSW during detailed design of the Stage 2 Project, ensuring provisions are made within the design to cater for proposed modifications to bus stop locations.

At the time of writing the EIS, confirmed modifications to existing bus stops include:

- Retention of existing bus stops, with adjustments to locations where required for road widening, with the exception of the westbound stop south of Fitzpatrick Avenue East which would be removed (as its current position is in the merge location of the westbound surface road/slot traffic)
- Provision of an extended bus bay to cater for two buses at the southbound bus stop on Forest Way (opposite the Forestway Shopping Centre)
- Provision of an indented bus bay at the existing bus stop on Wakehurst Parkway (southbound) north of Aquatic Drive.

The Stage 2 Project would retain existing bus priority measures at the Wakehurst Parkway and Forest Way intersections with Warringah Road. These include dedicated bus lanes on approach to and departure from the intersection.

Indented bus bays on Warringah Road at Hilmer St (entrance to the hospital site) were taken out of the design as traffic modelling indicated these would not be required (three lanes on the surface road provides sufficient capacity). Indented bays are also not supported without an adjacent bus lane due to difficulty for bus operators to exit (where the adjacent traffic is in a general use lane).

The Stage 2 Project provides suitable capacity to cater for road-based public transport.
5.1.6 Connections to existing roads and tie-ins

Activities to tie the Stage 2 Project into the existing road alignment and the Stage 1 Project would include pavement work to create consistent levels between existing and new surfaces. The extent of tie-in work would be determined during detailed design and would generally be carried out at the following locations:

- Warringah Road near the intersection of Maxwell Parade (Project’s western extent)
- Forest Way (three lanes in each direction) about 170 metres north of the Warringah Road intersection (tie in to the Stage 1 Project)
- Wakehurst Parkway from the Warringah Road intersection to about 150 metres south of Aquatic Drive
- Aquatic Drive about 150 metres east of the Wakehurst Parkway intersection
- Allambie Road at the Rodborough Road roundabout
- Warringah Road near the intersection of Allambie Road (tie in to the Stage 1 Project)
- Warringah Road and Rodborough Road intersection.

The proposed footpaths would also tie in to the existing landscape.

5.1.7 Drainage

Stormwater runoff from the widened sections of road pavement would be controlled by new or upgraded pit and pipe pavement drainage systems which would typically discharge to Council’s existing piped stormwater drainage system.

For the majority of the Stage 2 Project’s new and upgraded road drainage systems, including the slot drainage design, a 100 year Average Recurrence Interval (ARI) system capacity would be provided. 100 year ARI flood depths on the road would generally be below 50 millimetres, except at the junction of east and west draining pipes in the slot (approximately 60 metres west of Wakehurst Parkway) where surface water would pool on the road up to 200 millimetres in depth and five metres wide during the 100-year ARI flood event.

In addition to the above, the slot drainage design would include provision for separation of groundwater inflow and surface water and include capture, treatment and discharge requirements for groundwater. The design would be based on inflow estimates provided in Appendix M and would consider the amount of treatment required on a long term (operational) basis and would typically discharge to Council’s existing piped stormwater drainage system following treatment (as required). Slot drainage design and groundwater management during operation is further discussed in Section 17.6.

The Stage 2 Project concept design proposes two separate below ground detention storages, one at the southeastern corner of the intersection of Fitzpatrick Avenue East and Warringah Road and one below Aquatic Drive at the intersection of Wakehurst Parkway. The proposed detention basins at Aquatic Drive and Fitzpatrick Avenue East are designed to reduce peak 5-year, 10-year and 100-year flows back to existing levels at the outlet. Where the Stage 2 Project’s new or upgraded road drainage systems connects to natural drainage lines (e.g. in locations south of Warringah Road), there would be a need to provide scour protection to prevent erosion and scour, such as a rock rip rap apron with an energy dissipation structure. Similarly, to maintain hydrological performance and minimise potential erosion and scour, minor realignment to the
natural drainage lines may be required immediately adjacent the inlet and outlet of the new cross-
drainage under Wakehurst Parkway, south of the Warringah Road intersection.

The final design and configuration of the culverts and drainage systems would be confirmed
during the detailed design phase of the Stage 2 Project. A detailed description of the proposed
drainage upgrades, including an assessment of the Project’s hydraulic and hydrological impacts,
is summarised in Section 16.

5.1.8 Operational water quality measures

Stage 2 operational water quality measures have been considered in relation to the potential
pollutant loads at select locations within the broader catchment, both under present day and post-
Stage 2 Project conditions.

The Stage 2 Project would maintain or improve existing water quality conditions during operation
at most locations unless otherwise agreed by the EPA and/or NOW. Slightly higher nitrogen
concentrations were simulated (through MUSIC modelling) to be localised to a small area in the
Curl Curl Creek catchment directly downstream of the Stage 2 Project. However, the increases in
nitrogen were considered to be within the range of the existing conditions and are not considered
to be significant (refer to Section 16.5.1).

The final Stage 2 Project design would be consistent with the Concept Proposal surface water
strategy and would aim to rationalise the number of water quality and quantity control structures
by taking a holistic approach to water management within the urbanised catchments contributing
runoff to Bantry Bay Creek and Curl Curl Creek.

As detailed for the Concept Proposal, spill containment requirements associated with the slot
would focus on drainage lines discharging to receiving environments where investigations have
identified Red-crowned Toadlet habitat. Detailed design would investigate opportunities to include
spill containment provisions in conjunction with the proposed separate below ground detention
storages in the vicinity of the Aquatic Drive and Wakehurst Parkway intersection.

Provisions for the temporary containment of water used to wash down the walls of the slot are
dependent on the material/surface finish of the architectural panels. Some materials offer
self-cleansing properties and would not require the need for specific sub-surface tanks.
Notwithstanding, wall wash down and other maintenance requirements would be considered
dering detailed design.

The final design and configuration of operational water quality measures would be confirmed
during the detailed design phase of the Stage 2 Project. A detailed description of the proposed
water quality measures, including an assessment of the Project’s hydraulic and hydrological
impacts, is summarised in Section 16.

5.1.9 Cuttings, embankments and retaining walls

The Stage 2 Project has been designed to minimise areas requiring cut and fill along the
alignment. Cutting and/or filling would be required where the vertical alignment of the road is not
able to follow existing raised topography or where the road traverses a siding. Treatment of the
embankment faces would consist of planting in order to reduce the potential for erosion. In most
cases associated with areas of cutting or filling, retaining walls would be employed.

Retaining walls would be provided at various locations within the Stage 2 Project. Details of the
assumed dimensions and locations for the proposed retaining walls are provided in Table 5.2.
The final location and dimensions of all retaining walls would be confirmed during detailed design.
### Table 5.2 Stage 2 Project retaining walls

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warringah Road west of the intersection with Fitzpatrick Avenue East</td>
<td>A retaining wall facing away from the road (in fill), with a maximum height of about 1.0 metre, would be required along the front curtilage of up to four existing residential properties on Warringah Road west of the intersection with Fitzpatrick Avenue East.</td>
</tr>
<tr>
<td>Warringah Road near Karingal Crescent</td>
<td>A retaining wall facing the road (in cut), with a maximum height of about 4.3 metres, would be required to minimise encroachment on private property backing on to Warringah Road from Karingal Crescent.</td>
</tr>
<tr>
<td>South-west of the intersection of Warringah Road with Wakehurst Parkway</td>
<td>A retaining wall facing away from the road (in fill), with a maximum height of about 6.0 metres, would be required in order to minimise encroachment on the Brick Pit Reserve, south of the intersection of Warringah Road with Wakehurst Parkway.</td>
</tr>
<tr>
<td>South-east of the intersection of Warringah Road with Wakehurst Parkway</td>
<td>A retaining wall facing away from the road (in fill), with a maximum height of about 6.1 metres, would be required in order to minimise encroachment on vegetation consistent with the Duffys Forest (EEC) and commercial properties, south of the intersection of Warringah Road with Wakehurst Parkway.</td>
</tr>
<tr>
<td>Both sides of Wakehurst Parkway</td>
<td>Retaining walls facing away from the road (in fill), with a maximum height of about 3.9 metres, would be required on both sides of Wakehurst Parkway north of Aquatic Drive and one metre facing to the road (in cut) south of Aquatic Drive. These retaining walls minimise encroachment on existing vegetation.</td>
</tr>
<tr>
<td>Aquatic Drive</td>
<td>Retaining walls facing away from the road (in fill), with a maximum height of about two metres, would be required either side of Aquatic Drive, in order to minimise encroachment on existing vegetation.</td>
</tr>
</tbody>
</table>

Retaining structures, with a maximum height of up to eight metres, would be required on both sides of the central slot in order to allow four lanes of Warringah Road to pass beneath the intersections at Forest Way, Hilmer Street and Wakehurst Parkway.

Retaining walls would be finished in materials and colours that are complementary to the urban bushland setting of the Project. Retaining wall finishes would be of a high quality and would avoid the use of shotcrete.

#### 5.1.10 Roadside furniture and lighting

Roadside furniture elements would be included along the length of the Stage 2 Project for safety reasons, indicating delineation and directional guidance. Indicative details of the street furniture are provided in Table 5.3. All roadside furniture elements would be designed in accordance with the urban design objectives set out in Section 5.2. The location and design of these elements would be further refined during detailed design.
### Table 5.3 Roadside furniture

<table>
<thead>
<tr>
<th>Item</th>
<th>Indicative details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise barriers</td>
<td>Noise barriers would likely be required along the rear boundaries of properties on Panorama Crescent between the Sydney Water pipeline and Fitzpatrick Avenue East, along the southern verge of Warringah Road from Fitzpatrick Avenue East to Hilmer Street, and from Hilmer Street to Bantry Bay Road. Noise barriers may be up to four metres in height in order to effectively mitigate noise impacts on local residents. Due to the large scale of these devices, a high quality finish is required.[2.5ex]Barriers would be constructed of appropriate materials that considers structural and maintenance requirements while delivering the urban design objectives detailed in Section 5.2. Barriers are to be integrated with other barrier types in accordance with Roads and Maritime guidelines. If/where used, concrete panels are to include texture and/or form lining, reflecting local context.[2.5ex]Translucent material may be appropriate in some locations to allow solar access while still addressing privacy considerations. Where used, surfaces should include patternation or colour to mitigate bird impacts.</td>
</tr>
<tr>
<td>Bus shelters</td>
<td>Locations would be redesigned to suit planned bus route upgrades by Transport for NSW. Shelters would be designed to Warringah Council requirements. Currently bus stops have been proposed in order to maintain existing services, routes and locations.</td>
</tr>
<tr>
<td>Fences and barriers</td>
<td>Some fencing would need to be replaced, modified or repaired as a result of the Stage 2 project. These fences would primarily be associated with strips of private property that would be acquired for road widening. Suitable fencing materials, like for like, would be provided.[2.5ex]Barriers would be required along the central slot, bridges, shared pedestrian and cyclist bridges next to retaining walls.</td>
</tr>
<tr>
<td>Fauna fencing and aerial fauna crossings</td>
<td>Fauna fencing would be considered during detailed design as part of the Wildlife Connectivity Strategy (refer to Appendix E) for the project. Where considered appropriate, permanent floppy-top fencing would be installed on both sides of the road, directing animals to fauna culverts beneath the road.[2.5ex]Rope ladders consist of a single rope, ladder or rope tunnel that starts within existing vegetation and spans the entire road. Rope ladders would be considered during detailed design for arboreal fauna which do not utilise the fauna culverts.[2.5ex]The location and extent of fauna fencing and aerial fauna crossings would be determined at the detailed design phase.</td>
</tr>
<tr>
<td>Line marking</td>
<td>Line marking would be in accordance with Roads and Maritime standards and would include reflective lines and raised pavement markers. Additional delineation would be provided by way of standard reflectors on safety barriers and guideposts.</td>
</tr>
<tr>
<td>Traffic signs</td>
<td>Traffic signs would be provided to ensure legibility, consistency and compatibility between the project and the State road network, and would satisfy regulatory requirements.[2.5ex]The signposting design would be developed in accordance with Roads and Maritime guidelines and in consultation with relevant stakeholders.</td>
</tr>
<tr>
<td>Lighting</td>
<td>Lighting would be retained or upgraded throughout the project, in accordance with AS/NZS 1158 Code of Practice for Public Lighting.</td>
</tr>
</tbody>
</table>
Lighting is currently provided throughout the Stage 2 road corridor. Some changes to lighting may be required to accommodate widening work. Any new lighting or modifications to existing lighting and that within the slot and underpass locations would be consistent with AS4282-1997 Control of the Obtrusive Effects of Outdoor Lighting.

**Intelligent transport system**

An intelligent transport system is proposed as part of the project which would include three variable message signs on key arterial roads. Indicative locations of the proposed signs are shown in Figure 5.1 to Figure 5.4 and are near Allambie Road along the southern side of Warringah Road, on the northern side of Warringah Road approaching Forest Way, and on the northern side of Forest Way approaching Naree Road.

Variable message signs are large electronic traffic message devices that display traffic information and provide advice to road users with both real-time information about road and traffic conditions and incident management and advance information about potential traffic impacts and changes to road networks as a result of major events or road maintenance activities. Each sign would be up to nine metres long and up to two metres high, and would be suspended about five metres above the roadway on a cantilever gantry structure.

The selection, placement and assessment of VMS structures is guided by the Roads and Maritime Guideline *TDT 2005/ 02b Guidelines for the location and placement of variable message signs document* (Roads and Traffic Authority, 2008). A detailed visual assessment can be found in the Lanscape Character and Visual Impact Assessment Working Paper (Appendix G), with variable message signs also identified in the landscape character assessment in Section 11.5.1 of this EIS.

Other elements of the intelligent transport system include a number of video surveillance cameras which are proposed at key locations on the network. The elements of the intelligent transport system would be connected by a new cable network (identified in Section 5.1.12).

### 5.1.11 Incident management

There are median breaks in the slot west of Forest Way and east of Wakehurst Parkway that are designed for emergency cross overs for the purposes of incident management. A break down bay is provided between Forest Way and Hilmer Street in both the eastbound and westbound direction in the slot.

### 5.1.12 Utility services, adjustment and protection

Service investigations indicated that water mains, sewer mains, gas, telecommunications, optic fibre and electrical local distribution and transmission lines, and Intelligent Transport System infrastructure would require relocation or adjustment as a result of the Stage 2 Project. Plans of utilities in the vicinity of the project were obtained through ‘Dial before you Dig’ during concept design and were supplemented by three dimensional surveys of the concept design. This information was used as the basis for identifying the utilities likely to be affected by construction of the Stage 2 Project. The following utilities have been identified during concept design development, as being impacted by Stage 2 Project construction:

- Gas
- Water
- Sewer
Utility adjustments form a critical and complex enabling work as part of the Northern Beaches Hospital Road Connectivity and Network Enhancement Project Concept Proposal. To facilitate effective management of this work there is a need to carry out the Stage 1 Project and Stage 2 Project utility adjustments concurrently due to the overlap between both project areas. To minimise environmental impacts associated with the need for a number of temporary or ‘sacrificial’ utility work that would be required between the interfaces with Stage 1 Project and Stage 2 Project, the preferred approach is to include all utility adjustment work from the Stage 2 Project area into the Stage 1 Project approval. This will enable all utility services, adjustments and protection work to occur prior to key road construction activities of the Stage 1 Project and Stage 2 Project commencing. As such, utility adjustments and the associated construction work have been assessed as part of the Stage 1 Project approval, and are not considered as part of the Stage 2 Project EIS.

5.1.13 Property access and acquisition

Property access

The Stage 2 Project would seek to maintain driveway access to all existing properties with the exception of properties subject to total acquisition as detailed below. Where the current driveway access points cannot be maintained, entrances to properties would be relocated. Consultation with property owners about their individual property accesses has been carried out and is summarised in Section 6.3.

Land acquisition

To accommodate construction of the Stage 2 Project, the acquisition of about 31,713 square metres of property is required. Acquisition would be required across 35 separate properties (refer to Table 5.4 and Figure 5.10) including residential, parkland, and government owned land.

Land acquisition has commenced and is being carried out in accordance with the Roads and Maritime Land Acquisition Guide (RTA, 2011) and the conditions outlined in the Roads Act 1993 and Land Acquisition (Just Terms Compensation) Act 1991.

<table>
<thead>
<tr>
<th>Lot</th>
<th>DP or SP</th>
<th>Zoning</th>
<th>Total/Strip acquisition</th>
<th>Approximate area (square metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warringah Road</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>28467</td>
<td>R2</td>
<td>Strip</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>28467</td>
<td>R2</td>
<td>Strip</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>28467</td>
<td>R2</td>
<td>Total</td>
<td>898</td>
</tr>
<tr>
<td>6</td>
<td>28467</td>
<td>R2</td>
<td>Total</td>
<td>727.2</td>
</tr>
<tr>
<td>4</td>
<td>29379</td>
<td>R2</td>
<td>Total</td>
<td>739.8</td>
</tr>
<tr>
<td>Lot</td>
<td>DP or SP</td>
<td>Zoning</td>
<td>Total/Strip acquisition</td>
<td>Approximate area (square metres)</td>
</tr>
<tr>
<td>-----</td>
<td>----------</td>
<td>--------</td>
<td>-------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>29379</td>
<td>R2</td>
<td>Total</td>
<td>708.2</td>
</tr>
<tr>
<td>2</td>
<td>437859</td>
<td>RE1 (Council)</td>
<td>Total</td>
<td>1,277</td>
</tr>
<tr>
<td>B</td>
<td>36616</td>
<td>RE1 (Council)</td>
<td>Strip</td>
<td>3065</td>
</tr>
<tr>
<td>C</td>
<td>36616</td>
<td>RE1 (Council)</td>
<td>Strip</td>
<td>9130</td>
</tr>
<tr>
<td>D</td>
<td>36616</td>
<td>RE1 (Council)</td>
<td>Strip</td>
<td>1515</td>
</tr>
<tr>
<td>5</td>
<td>777484</td>
<td>R2</td>
<td>Total</td>
<td>593.8</td>
</tr>
<tr>
<td>1</td>
<td>841995</td>
<td>R2</td>
<td>Total</td>
<td>317.1</td>
</tr>
<tr>
<td>2</td>
<td>841995</td>
<td>R2</td>
<td>Total</td>
<td>276.7</td>
</tr>
<tr>
<td>71</td>
<td>878123</td>
<td>R2</td>
<td>Total</td>
<td>280</td>
</tr>
<tr>
<td>1</td>
<td>805245</td>
<td>B1</td>
<td>Total</td>
<td>1,885</td>
</tr>
<tr>
<td>B</td>
<td>397182</td>
<td>B1</td>
<td>Total</td>
<td>341.5</td>
</tr>
<tr>
<td>202</td>
<td>737157</td>
<td>B7</td>
<td>Strip</td>
<td>380</td>
</tr>
<tr>
<td>12</td>
<td>580560</td>
<td>RE1 (Council)</td>
<td>Strip</td>
<td>3,480</td>
</tr>
<tr>
<td>1</td>
<td>225569</td>
<td>RE1 (Council)</td>
<td>Strip</td>
<td>910</td>
</tr>
<tr>
<td>1</td>
<td>245508</td>
<td>RE1 (Council)</td>
<td>Strip</td>
<td>190</td>
</tr>
<tr>
<td>1</td>
<td>558009</td>
<td>RE1 (Council)</td>
<td>Strip</td>
<td>210</td>
</tr>
<tr>
<td>2</td>
<td>737409</td>
<td>B7 Business Park (CYC)</td>
<td>Strip</td>
<td>905</td>
</tr>
<tr>
<td>61</td>
<td>631410</td>
<td>RE1 (Council)</td>
<td>Strip</td>
<td>435</td>
</tr>
<tr>
<td>C</td>
<td>361887</td>
<td>RE1 (Council)</td>
<td>Strip</td>
<td>432</td>
</tr>
<tr>
<td>13</td>
<td>597191</td>
<td>SP2 (Minister Administering The Environmental Planning and Assessment Act)</td>
<td>Strip</td>
<td>130</td>
</tr>
</tbody>
</table>

Hilmer Street

<table>
<thead>
<tr>
<th>Lot</th>
<th>DP or SP</th>
<th>Zoning</th>
<th>Total/Strip acquisition</th>
<th>Approximate area (square metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>878123</td>
<td>R2</td>
<td>Total</td>
<td>324.7</td>
</tr>
</tbody>
</table>

Bantry Bay Road

<table>
<thead>
<tr>
<th>Lot</th>
<th>DP or SP</th>
<th>Zoning</th>
<th>Total/Strip acquisition</th>
<th>Approximate area (square metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>397182</td>
<td>B1</td>
<td>Total</td>
<td>341.5</td>
</tr>
<tr>
<td>20</td>
<td>SP22383</td>
<td>B1</td>
<td>Total</td>
<td>235</td>
</tr>
<tr>
<td>14</td>
<td>15045</td>
<td>B1</td>
<td>Total</td>
<td>221.3</td>
</tr>
<tr>
<td>15</td>
<td>15045</td>
<td>B1</td>
<td>Total</td>
<td>221.3</td>
</tr>
<tr>
<td>16</td>
<td>15045</td>
<td>B1</td>
<td>Total</td>
<td>221.3</td>
</tr>
<tr>
<td>Lot</td>
<td>DP or SP</td>
<td>Zoning</td>
<td>Total/Strip acquisition</td>
<td>Approximate area (square metres)</td>
</tr>
<tr>
<td>-----</td>
<td>----------</td>
<td>----------------------</td>
<td>-------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tilley Lane</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>SP79977</td>
<td>B7</td>
<td>Strip</td>
<td>937</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forest Way</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>706259</td>
<td>R2</td>
<td>Strip</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aquatic Drive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>597191</td>
<td>RE1 – Dept of Planning</td>
<td>Strip</td>
<td>80</td>
</tr>
<tr>
<td>7349</td>
<td>1167548</td>
<td>RE1, E2 – Crown land</td>
<td>Strip</td>
<td>80</td>
</tr>
</tbody>
</table>

Property acquisition requirements would be refined during the detailed design process. Locations and areas included in Table 5.4 representing locations and areas known at the time of concept design and preparation of this EIS and represent the locations and areas that are currently in the process of being acquired by Roads and Maritime.

The parcel of land identified for site compound purposes, at the corner of Allambie Road and Aquatic Drive, is Crown Land and use of this parcel would be subject to a lease agreement from the Crown.

A parcel of Commonwealth land is located on Warringah Road, about 100 metres west of Forest Way. At this location, the design has been refined to avoid direct impact to Commonwealth land.
Properties identified for acquisition

Property acquisitions
- Full acquisition
- Partial acquisition

Figure 5-10
5.2 Project design

5.2.1 Design standards

The road work component of the Stage 2 Project would be designed generally in accordance with Australian Standards, Austroads Design Standards, Guides and Codes and Roads and Maritime supplements.

5.2.2 Design criteria

Table 5.5 summarises design parameters applied to the road work component of the project.

<table>
<thead>
<tr>
<th>Table 5.5 Design parameters for road work</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parameter</strong></td>
</tr>
<tr>
<td>Grade</td>
</tr>
<tr>
<td>Lane widths (minimum)</td>
</tr>
<tr>
<td>Surface roads (variable depending on the road)</td>
</tr>
<tr>
<td>Medians</td>
</tr>
<tr>
<td>Surface roads:</td>
</tr>
<tr>
<td>Max – 2.5m</td>
</tr>
<tr>
<td>Footpath (minimum clear width)</td>
</tr>
<tr>
<td>Shared path : 2.5 or 3.0m (location dependent)</td>
</tr>
<tr>
<td>Batters</td>
</tr>
<tr>
<td>Fill batters – 1:4</td>
</tr>
<tr>
<td>Cut batters – 1:3</td>
</tr>
<tr>
<td>Wakehurst Parkway:</td>
</tr>
<tr>
<td>Cut batters – 1:2</td>
</tr>
<tr>
<td>Crossfall</td>
</tr>
<tr>
<td>Maximum crossfall for superelevation – 4%</td>
</tr>
<tr>
<td>Pavement drainage</td>
</tr>
<tr>
<td>Pavement in slot (sag) – 1 in 100 year ARI</td>
</tr>
<tr>
<td>Bus bays</td>
</tr>
</tbody>
</table>

Posted speed limit

The Stage 2 Project would have a posted speed limit of:

- 70 km/h on Forest Way, Warringah Road and Wakehurst Parkway
- 40 km/h on Warringah Road in designated school zone areas from 8am to 9.30am, and from 2.30pm to 4pm (Roads and Maritime may remove the school zone pending further investigations during detailed design and discussions with DEC)
• 50 km/h on Aquatic Drive
• 60 km/h on Allambie Road south of Warringah Road.

Typical cross section
The Stage 2 Project has been designed in accordance with Austroad guidelines and Roads and Maritime’s technical supplements. Typical cross sections adopted for the project are shown in Figure 5.11 and Figure 5.12.
**Figure 5.11** Indicative cross section at the location of the Forest Way pedestrian and shared path bridge
Figure 5.12 Indicative cross section at the location of the Hilmer Street pedestrian and shared path bridge
Typical through lane widths in each direction are 3.2 metres in the slot, and of varying widths between 2.8 metres and 3.5 metres on surface road sections of Warringah Road, Forest Way, Wakehurst Parkway and Aquatic Drive. Localised widening for the provision of turn bays would be accommodated at intersection approaches.

A painted median would be provided for the majority of the project area, with the exception of Forest Way, Wakehurst Parkway and Warringah Road where concrete medians would be provided at various locations.

5.2.3 Urban design criteria

Urban design objectives and principles have been prepared to guide design of the Concept Proposal (refer to Section 5.1.2 and 5.1.3), which includes the Stage 2 Project. These objectives and principles have been applied to the development of the Stage 2 Project urban design.

A series of indicative concept design sections have been have been prepared to describe the Stage 2 Project concept road design and urban and landscape design (Appendix G). The detailed design would be further developed in subsequent design stages.

5.2.4 Urban design framework

An urban design framework (KI studio, 2013) has been prepared to provide urban design guidance for the Concept Proposal, in context with the development of the Northern Beaches Hospital and Precinct. The framework is of a strategic nature, guiding urban design objectives and principles to mitigate landscape character and visual impacts for the Concept Proposal.

The urban design framework aims to:
- Reinforce the location of the hospital
- Take into consideration urban permeability and alternative modes of transport
- Consider the future desired character
- Reconcile functional road infrastructure requirements with the visual and physical character of the Concept Proposal and Northern Beaches Hospital Precinct.

The urban design framework establishes design objectives and principles to be applied to each stage of the Concept Proposal.

Urban design objectives and principles

The aim of the urban design is to ensure that the Stage 2 Project is physically and visually integrated with its surrounding environment and, where possible, maximises engagement of the road user with local context in order to provide a more enjoyable and interesting driving experience.

In order to meet this aim, a set of key urban design objectives has been developed. These objectives reference Roads and Maritime’s Beyond the Pavement and other key guidelines. The objectives are based on an understanding of the key existing landscape and urban values and the landscape and urban design issues that affect, or are affected by, the proposed work.
The urban design objectives are:

- Retain and reinforce the parkway character of Warringah Road and Wakehurst Parkway and distinguish the ecological character of Wakehurst Parkway from the more formal and urbanised parkland character of Warringah Road
- Reinforce the lush and green character of the area and express the bushland character
- 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, and provide opportunities for urban restructuring and redevelopment
- Define the address of the hospital locality as well as expressing the area as a gateway to the Northern Beaches
- Create a clear structural framework for streetscapes that enhances the legibility, way-finding and functioning of the precinct
- Design integrated urban infrastructure/landscape design elements that allow the landscape to dominate built forms to recede.

A series of urban design principles have been developed to ensure that the urban and landscape design objectives are achieved by the Stage 2 Project. The purpose of these principles is to integrate sound urban design practice into all aspects of the concept design development, and also inform the detailed design and construction phases of the project.

The urban design principles relate to three broad areas of design influence:

- Road alignment design – The design of the location and geometry of the proposal
- Road elements design – Input into the design of structures, fences and furniture that are necessary to achieve the road alignment or are required for the effective operation of the road
- Landscape design – The design of new planting or revegetation areas in order to integrate the proposal with the existing local landscape character and natural patterns, and to provide interest to the road users and pedestrians.

A landscape character and visual impact assessment is provided in Section 11 and Appendix G. The interrelationship between the urban design objectives, their associated urban design principles and the areas of the Stage 2 Project that they influence are also detailed in Section 11 (refer to Table 11.4).

Landscape framework

A landscape framework has been developed for the Concept Proposal which provides the structural layout for the Stage 2 Project, while being responsive to the design objectives. It responds to the five key landscape character precincts (refer to Section 11.2.1) identified within the project which reflect the corresponding natural and built environments.

Landscape design objectives have been developed to ensure that each stage of the Concept Proposal, including the Stage 2 Project:

- Responds to the existing landscape character and vegetation communities
- Utilises indigenous seed that is sourced from the local area, or where not available, from other suitable locations
• Utilises a variety of techniques in order to provide a vegetative cover to all surfaces impacted by the work

• Includes contingencies for seasonal and unexpected conditions that might impact revegetation success.

The landscape treatment details would be finalised during detailed design and is subject to consultation with relevant stakeholders.

5.3 Construction work

This section describes the likely approach to construction of the Stage 2 Project including pre-construction activities, staging, early work, construction methods, earthwork, materials, equipment, working hours and temporary construction facilities. Detailed construction planning would occur prior to construction commencing and would consider methods and scheduling to manage community and environmental issues including noise, access, amenity and general disruption. The details of construction would be finalised prior to construction and detailed in the Construction Environmental Management Plan (CEMP).

5.3.1 Construction program

The Stage 2 Project would be delivered in a single construction program starting in early 2016, with completion planned for mid-2018 based on a dry weather program, however all work is scheduled to be completed in time for the opening of the hospital which is planned for late 2018. Based on a dry weather program construction is expected to take about 30 months to complete (weather permitting).

An indicative construction scenario is provided in Section 5.4.1 outlining how the construction program may be staged to minimise disruption to traffic and access. Staging within the construction program would be determined by the construction contractor during detailed design and construction planning.

The Stage 1 Project and utilities relocation for the Stage 1 and Stage 2 Projects will commence construction in the second half of 2015 and will take about 24 months to complete. Construction of the Northern Beaches Hospital is commencing in 2015 for completion in 2018. Construction coordination mechanisms relating to the potential concurrent construction programs of the Northern Beaches Hospital, the Stage 1 Project and Stage 2 Project are discussed in Section 5.4.2. An assessment of cumulative construction impacts is provided in Section 20.3.3.

5.3.2 Construction footprint

The construction methodology, and subsequent construction footprint (herein the construction impact area), has been refined (to the greatest feasible extent) to minimise the Stage 2 Project footprint. Figure 5.13 identifies the Stage 2 Project footprint, including the construction impact area of the project, which is assessed in this EIS. The construction impact area varies between 15 metres to 100 metres wide (including the existing road pavement area), depending on topography or environmental constraints.

For the purposes of this EIS, the construction impact area refers to those areas that would be directly impacted during construction including locations of compound sites. The term study area varies across individual specialist studies and refers to the area that has been investigated to identify and assess the potential direct and indirect impacts of the Stage 2 Project.
5.3.3 Construction methodology

Construction methods used would be conventional techniques employed on road projects, adapted to account for project-specific environmental and social constraints, to ensure the Stage 2 Project is constructed in a safe, operationally functional and efficient manner.

Equipment and plant requirements would be refined during detailed design and during the development of the construction methodology by the construction contractor. Details of the proposed pre-construction and construction activities, including the potential duration of each construction activity, are summarised in Table 5.6 with more detail of each activity provided in the following section.

Construction activities would be confined predominantly to the Stage 2 Project construction impact area as described in Section 5.3.2 and illustrated on Figure 5.13. However, certain minor activities, such as temporary traffic staging work, property adjustment work and implementation of mitigation measures may extend beyond the area illustrated on Figure 5.13. Construction activities and work within each stage may occur concurrently.
## Table 5.6 Potential pre-construction and construction activities

<table>
<thead>
<tr>
<th>Construction activity</th>
<th>Proposed work</th>
<th>Plant and equipment</th>
<th>Approximate duration</th>
</tr>
</thead>
</table>
| Enabling work         | • Notify residents of construction work  
• Leasing or acquisition of land  
• Carry out additional surveys and investigative work including dilapidation surveys, infrastructure and geotechnical investigations as required  
• Road and intersection modifications and installation of traffic controls and signage  
• Establishment of construction site compound  
• Installation of temporary traffic controls and line marking  
• Installation of temporary (construction) signage and lighting  
• Implementation of initial environmental safeguards  
• Minor clearing work  
• Property demolition work  
• Fencing of the construction areas of the road corridor, including marking out of construction impact area  
• Application of construction noise attenuation as described in Section 8.6. | Line marking equipment, geotechnical equipment, fences, portable sheds, portable toilets and fuel storage tanks. | 1–6 months           |
<table>
<thead>
<tr>
<th>Construction activity</th>
<th>Proposed work</th>
<th>Plant and equipment</th>
<th>Approximate duration</th>
</tr>
</thead>
</table>
| Site preparation      | · Prior to vegetation clearing the following activities would be carried out:  
|                       |   - Pre-clearing surveys  
|                       |   - marking out no go zones  
|                       |   - identifying fauna habitat trees through pre-clearing surveys.  
|                       |   · Installation of temporary and/or permanent fauna fencing  
|                       |   · Vegetation clearing and grubbing  
|                       |   · Processing (including recycling) of various materials for use in landscaping activities  
|                       |   · Installation of site sediment and erosion controls and pollution management measures  
|                       |   · Construction of temporary diversion drains  
|                       |   · Stripping and stockpiling of topsoil for reuse  
|                       |   · Adjustment of some property accesses  
|                       |   · Property demolition and rehabilitation work. | Trucks, bulldozers, excavators, front end loaders, backhoes, road sweepers and small equipment. | 1–3 months |
| Road widening Warringah Road (westbound) and pavements (and sections of Wakehurst Parkway and Allambie Road) | · Installation of permanent noise barriers for identified impacted properties  
|                       | · Remediation as required of service station site  
|                       | · Installation of retaining walls on the southern side of Warringah Road  
|                       | · Construction of the new westbound lanes on the southern side of Warringah Road:  
|                       |   - Excavate and box out road widening sections  
|                       |   - Stabilise and compact the existing sub-grade material  
|                       |   - Construction of pavement layers including selected material, sub-surface drainage, sub-base, base layers and surfacing.  
|                       | · Switch traffic onto new westbound alignment to enable construction of the slot  
<p>|                       | · Construction of shared paths. | Trucks, front end loaders, bulldozers, excavators, graders, road sweepers, concrete trucks, water carts, elevated work platforms, jack hammers, concrete saws, vibratory rollers, asphalt/concrete pavers, compactors, generators, trenching equipment, bitumen sprayers, line marking machine. | 12 months |</p>
<table>
<thead>
<tr>
<th>Construction activity</th>
<th>Proposed work</th>
<th>Plant and equipment</th>
<th>Approximate duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slot construction</td>
<td>• Installation of rows of piles for slot construction</td>
<td>Trucks, bulldozers, excavators, front end loaders, road sweepers, jack hammers, concrete saws, vibratory rollers, graders, water carts, compactors, crushing and screening plant, elevated work platform.</td>
<td>18 months</td>
</tr>
<tr>
<td></td>
<td>• Excavation of soil between rows of piles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Installation of soil anchors and shotcrete</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Excavation of rock to the designed depth</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Removal and stockpiling of spoil and unsuitable material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Based on estimates drawn from the concept design, it is estimated that there would be about 180,000 cubic metres of cut (spoil) produced, and 7,500 cubic metres of fill required for the project. Where possible cut would be re-used as fill for the project. Preferential disposal options for excess cut are discussed in Section 18</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Installation of subsoil drainage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Installation of slot pavement and slot walls.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intersection work (major)</td>
<td>• Adjustment of turning traffic to allow access for intersection bridge cover construction</td>
<td>Piling rig (bored), mobile crane, concrete pump, concrete truck/agitator, daymakers, excavator, bogies.</td>
<td>12 months</td>
</tr>
<tr>
<td></td>
<td>• Installation of piles and excavation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Installation of cover abutments, planks and concrete deck</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Switching of traffic to the newly constructed cover.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intersection work (minor)</td>
<td>• Construction of new connections at Aquatic Drive</td>
<td>Grader, excavator, bitumen spray truck, paving machine, water tanker, vibratory roller, multi-tyred roller, line marking plant</td>
<td>9 months</td>
</tr>
<tr>
<td></td>
<td>• Embankments would be widened and one new lane constructed on the outside of the existing southbound lane on Wakehurst Parkway.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New road connections</td>
<td>• Integration of the new work with the existing road network.</td>
<td>Grader, excavator, bitumen spray truck, paving machine, water tanker, vibratory roller, multi-tyred roller, line marking plant</td>
<td>15 months</td>
</tr>
<tr>
<td>Construction activity</td>
<td>Proposed work</td>
<td>Plant and equipment</td>
<td>Approximate duration</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Pedestrian and cyclist bridges</td>
<td>• Demolition and removal of existing pedestrian bridge west of Forest Way</td>
<td>Piling rig (bored), excavator, concrete pump, concrete truck/agitator, daymakers, grader, excavator, bitumen spray truck, paving machine, water tanker, vibratory roller, multi-tyred roller.</td>
<td>9 months</td>
</tr>
<tr>
<td></td>
<td>• Construction of foundation and piers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Installation of bridge abutments</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Installation of bridge structures</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Installation of lighting and safety screen</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Connections with shared paths</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Testing and commissioning</td>
<td>• Testing of variable message signs.</td>
<td></td>
<td>6 months</td>
</tr>
<tr>
<td>Other work</td>
<td>• Installation of lighting and roadside furniture</td>
<td>Trucks, fencing and barrier materials, landscaping materials, cranes, line marking machine and small equipment.</td>
<td>1–2 months</td>
</tr>
<tr>
<td></td>
<td>• Installation of traffic lights</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Line marking</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Sign posting</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Landscaping</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Relocation of property accesses</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Detention basins</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• VMS installation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finishing work</td>
<td>• Removal of temporary work</td>
<td>Trucks and landscaping materials.</td>
<td>1–2 months</td>
</tr>
<tr>
<td></td>
<td>• Rehabilitation of disturbed areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Restoration and landscaping of construction compounds</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Site clean-up, re-use of or disposal of any remaining surplus waste materials.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Enabling work

Enabling work is work that would generally take place early in the construction program in order to facilitate the main construction activities. Enabling work for the Stage 2 Project would include:

- Survey work
- Existing condition surveys of adjacent buildings and infrastructure
- Geotechnical drilling or excavation
- Property acquisitions
- Property demolition work
- Installation of construction signage and advisory signs
- Traffic management changes to allow access to and egress from the construction sites
- Implementation of temporary pedestrian and/or cyclist diversions
- Installation of environmental control measures, including erosion and sedimentation controls, construction hoardings, and temporary and/or permanent fauna fencing
- Minor clearing work.

Demolition work

The Stage 2 Project has been designed to minimise land acquisition and property demolition as far as practical. However, demolition is proposed for about 16 properties located within the construction footprint. Widening proposed for the Warringah Road westbound lanes requires the demolition of properties:

- West of Fitzpatrick Avenue
- West of Hilmer Street
- Between Hilmer Street and Bantry Bay Road (commercial properties).

The final number of demolitions would be determined during detailed design.

Generally, demolition work would be carried out early in the construction program to ensure site readiness and to allow main construction activities to commence. Demolition work would be carried out using accredited demolition contractors and, where required, suitably accredited contractors to handle any hazardous waste such as asbestos. Demolition and rehabilitation of the service station site would ensure all land is remediated to a standard that is suitable for the planned land use.

Warringah Road (westbound) work

To gain access to construct the slot, the existing westbound lanes of Warringah Road would be relocated south onto the proposed permanent alignment of the westbound surface lanes. Construction of the new Warringah Road westbound lanes may be completed in multiple stages, subject to land acquisitions.

The work required to construct Warringah Road (westbound) would include:

- Construction of new westbound lanes and shared path on the southern side of Warringah Road
- Installation of retaining walls on the southern side of Warringah Road
- Installation of permanent noise barriers for identified impacted properties
• Movement of westbound traffic from the existing lanes onto the newly constructed westbound Warringah Road traffic lanes.

Permanent noise walls would be constructed as required by noise modelling outcomes (refer to Section 8.3 and shown in Figure 5.1 to Figure 5.4). Permanent noise walls would be constructed as early as practicable in the construction program. Noise wall locations would be confirmed during detailed design.

Construction of new noise walls would typically require:

• Clearing of vegetation
• Piling
• Construction of reinforced concrete footings and steel posts
• Installation of prefabricated panels.

Retaining walls would be constructed to limit the extent of the Stage 2 Project footprint (refer to Section 5.1.9).

Excavation for the proposed westbound surface lanes would generate approximately 55,000 cubic metres of cut material. The new alignment would require 7,500 cubic metres of fill, which, where suitable, would be sourced from the cut material. Material would be transported to either a fill location onsite or transported off site to an approved reuse or waste disposal facility.

Following excavation for the slot, a sub-base would be laid and a drainage network of concrete pipes and precast concrete pits installed. Following completion of drainage work, base course material would be imported and spread to form the permanent pavement. Kerb and gutter would be constructed on top of the base course layer. Asphalt surfacing would then be placed, followed by installation of signage and line marking.

Tie-ins to the existing Warringah Road pavement, at the eastern and western limits of work, would involve milling sections of the existing road surface and overlaying with new asphalt and line marking. With signage in place, traffic would be diverted onto the new westbound alignment of Warringah Road. This traffic switch would then enable access for the slot construction in the centre of the existing Warringah Road.

Slot construction

The slot would be centrally located on Warringah Road between the existing eastbound lanes and the proposed new alignment of the westbound lane (refer to Figure 5.1 to Figure 5.4). The slot would have variable height retaining structures, up to about eight metres. Further detail on a typical construction methodology is provided as follows but may be subject to refinement during detailed construction planning.

Slot construction would commence after westbound Warringah Road traffic has been moved to the new alignment on the southern side of Warringah Road.

The walls of the slot would potentially be constructed as either a series of bored piles drilled by large piling rigs, by rock excavation plus soil nailing method or by conventional reinforced concrete wall depending on the existing ground conditions and depth. Piles would either be socketed into rock of sufficient strength and terminated, or if no rock of sufficient strength is encountered, bored to an appropriate depth in the soil.
Given the width of the slot, two piling rigs may be required to work concurrently opposite each other in the slot, installing the two rows of piles forming the slot walls. After the piles have been constructed, the material in the slot would be excavated. It is anticipated that excavation of the slot would likely occur on two or more fronts.

A total of 125,000 cubic metres of material would be removed from the slot. For harder type sandstone, an excavator would be fitted with a hydraulic hammer, or rock breaker. As the excavation proceeds, rock anchors would be installed where required by the design at designated depths. These would be drilled at an angle through the concrete piles into underlying rock. Blasting is not proposed.

Material exposed between the bored piles would have a drainage medium placed on the exposed walls and then be sprayed with shotcrete, applied with a remote controlled spraying arm.

When excavation has reached the underside of the new pavement level, the drainage system described in Section 5.1.7 would be installed.

The pavements would then be constructed and kerbs and median barriers installed.

Architectural panels would be fixed to the face of the bored pile walls. The panels would be installed with a mobile crane assisted by elevated work platforms.

Final surfacing and line marking would be applied as a continuous activity on completion of the slot.

Forest Way, Hilmer Street & Wakehurst Parkway intersection work

Through traffic on Warringah Road would be grade separated from turning traffic at Forest Way, Hilmer Street and Wakehurst Parkway by way of underpasses. These underpasses would be formed by constructing a bridge cover spanning over the slot at each intersection.

The intersections at Forest Way, Hilmer Street and Wakehurst Parkway would be completed in at least two stages and likely follow a top-down construction method. For the first stage of the work, the existing intersection would be reconfigured so turn movements would clear the work zone. Construction staging would ensure the existing road capacity remains unchanged. One half of the cover would then be constructed in a dedicated work zone. The cover construction would involve bored piles, which would form both the walls of the slot and the foundations for the cover. Abutments would be constructed on top of the bored piers.

Once the piles for the first half of the cover are complete, approximately two metres of material would be excavated, which would allow cover planks to be placed, spanning the abutments. The cover comprises multiple pre-fabricated planks. Due to safety reasons, these planks would be installed over multiple nights using mobile cranes. A concrete deck would then be installed over the planks. Once the first half of the cover is in place, furnishings, including guardrail and throw screens would be installed.

After reconfiguring the turning traffic to use the newly constructed section of the slot cover, the second half of the cover would be constructed in a similar method to the first half. Traffic can then be reconfigured to the final layout.

The remaining excavation beneath the newly completed slot cover would be carried out as part of the slot construction work described earlier in this section.
New road connections

Two new road connections would be constructed at:

- Hilmer Street, which would be extended to the northern side of Warringah Road, providing southern access to the Northern Beaches Hospital
- Aquatic Drive, to extend the existing cul-de-sac to join Wakehurst Parkway.

The Hilmer Street extension would be completed after the cover has been placed over the slot at Hilmer Street on the southern side of Warringah Road.

Aquatic Drive would be extended to form an intersection with Wakehurst Parkway. Associated with the extension of Aquatic Drive is the widening of Wakehurst Parkway south of Warringah Road, which is presently configured as one lane in each direction.

Traditional road construction techniques would be used for the work to extend both Hilmer Street and Aquatic Drive. Construction would include:

- Embankments would be widened and one new lane constructed in each direction on the outside of the existing lane
- On completion of the new outer lanes the traffic would be moved onto those lanes
- Then two new inner lanes would then be modified in an isolated work zone.

These new road connections would be constructed concurrently with the slot construction work.

Project tie-ins

The proposed work would involve tie-ins with existing arterial and local roads (refer to Section 5.1.6). Where a new pavement has been constructed and meets with an existing road, the typical construction methodology would involve:

- Exposure of existing road face and alignment of substructures
- Placement of base and select layers of materials (in areas of earthwork only)
- Pavement drainage, including kerb and gutter (where required)
- Placing, compacting and finishing of concrete to form pavements
- Milling sections of the existing road
- Placing, compacting and finishing of open grade or dense grade asphalt wearing course
- Linemarking and signage.

Shared pedestrian and cyclist bridges

There are two shared pedestrian and cyclist bridges proposed to be constructed. The general locations are:

- West of Hilmer Street over Warringah Road
- West of Forest Way over Warringah Road, to replace the existing pedestrian bridge.

The bridges would comprise pre-fabricated bridge structures. For safety reasons, the decks will be installed at night using mobile cranes and temporary traffic arrangements to allow for road closures and diversions.
Bridge construction would typically involve:
- Construction of foundations and piers
- Installation of abutments
- Installation of pre-fabricated bridge structure
- Installation of throw screens, handrails and access ramps
- Landscaping

Landscaping would be carried out in accordance with the landscape framework detailed in Appendix G. Landscaping would occur progressively as construction work finish in specific areas.

Testing and commissioning
The project involves a number of mechanical and electrical elements that need to be tested and commissioned in readiness for operation (e.g. Variable Message Signs).

Site clean-up and demobilisation
At the completion of construction, temporary site construction sheds and offices would be removed and construction compounds would be rehabilitated to pre-construction conditions unless otherwise agreed with the landowner.

5.3.4 Construction materials
Construction would require various materials and pre-cast elements including, but not limited to:
- General fill and select fill for earthwork
- Pavement materials, including road base, sub-base and asphalt
- Materials for lining drainage channels
- Sand for use as backfill
- Aggregate
- Bitumen
- Concrete and asphalt
- Steel reinforcing and rock bolts
- Timber for use in formwork and other temporary structures
- Water for construction activities
- Pre-cast concrete elements, including pipes, culvert segments, roadside barriers and girders
- Architectural panels for slot walls and retaining walls
- Noise walls, including steel posts and prefabricated panels
- Topsoil
- Geotextiles and geofabric
- Lighting poles and lamps
- Fauna fencing and rope canopy bridges
- Road furniture and signage.
Table 5.7 provides estimates of the anticipated quantities of major materials.

**Table 5.7 Anticipated Quantities of Major Materials**

<table>
<thead>
<tr>
<th>Material</th>
<th>Estimated quantity required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piles – concrete</td>
<td>7000 cubic metres</td>
</tr>
<tr>
<td>Piles – steel reinforcing</td>
<td>1750 tonnes</td>
</tr>
<tr>
<td>Shotcrete – concrete</td>
<td>2500 cubic metres</td>
</tr>
<tr>
<td>Shotcrete – steel</td>
<td>125 tonne</td>
</tr>
<tr>
<td>Rock anchors</td>
<td>175 tonne</td>
</tr>
<tr>
<td>Concrete drainage pipes</td>
<td>4000 metres</td>
</tr>
<tr>
<td>Architectural Panels</td>
<td>7500 tonne</td>
</tr>
<tr>
<td>Precast planks for intersection covers</td>
<td>160 units (average length of 18 metres)</td>
</tr>
<tr>
<td>Slot intersection covers – concrete</td>
<td>1800 cubic metres</td>
</tr>
<tr>
<td>Slot intersection covers – steel</td>
<td>450 tonne</td>
</tr>
<tr>
<td>Crushed aggregate</td>
<td>30,000 tonne</td>
</tr>
<tr>
<td>Asphalt</td>
<td>11,000 tonne</td>
</tr>
</tbody>
</table>

The quantities of material required for the construction of the Stage 2 Project would be refined during the detailed design phase.

Excess cut or other material would be stockpiled and stabilised, and where possible re-used on site as part of the landscaping. Material that is deemed unsuitable would be appropriately disposed of in accordance with the waste management measures detailed for the Stage 2 Project in Section 18.5. Additional construction materials would be sourced off site. This may include fill or select material to address shortfalls in required volumes in the event that material won by the project is found to be unsuitable.

Construction material would be sourced from off-site suppliers. This would include the balance of fill material to address shortfalls in required volumes in the event that material sourced from on-site is unsuitable. Wherever possible, local sources of construction materials would be used where practical to minimise haul distances. The majority of raw and manufactured materials would be hauled from quarries and batch plants located within the Sydney Metropolitan area.

Pre-cast elements would be transported along existing road and internal haul roads directly to the work site.

5.3.5 Consumption of natural resources

Construction energy use

Equipment and vehicles on the construction site would consume up to 1.2 million litres of fuel (diesel and petrol) to construct the Stage 2 Project.

Electricity needs for the Stage 2 Project would be minor and connection of the site office to the local power grid would be sufficient. It is estimated that up to 20 million kilowatt hours of power
would be used to construct the Stage 2 Project. The final amount would depend on methodologies applied by the contractor.

Construction water

Construction of the project would require water (non-potable and potable) for the following activities:

- Dust suppression
- Compaction of excavated fill material
- Gravel pavements
- Road sweepers
- Potable use in office amenities.

It is estimated that up to 35 mega litres of water (non-potable and potable) would be used to construct the Stage 2 Project. The amount would depend on material sources and methodologies applied by the contractor. It is proposed that potable water would be obtained from Sydney Water’s water supply network. No surface or groundwater would be extracted for the purpose of construction. Notwithstanding, stormwater runoff collected in sediment basins or sumps may be reused for construction purposes (e.g. dust suppression or compaction) in accordance with environmental management requirements.

5.3.6 Construction ancillary facilities

As the Stage 2 Project would need to be constructed under traffic, there are very limited opportunities to locate construction compounds within the road corridor. Identification and assessment of the preferred compound sites for construction of the Concept Proposal was carried out as part of the Stage 1 Project EIS and Preferred Infrastructure Report (Roads and Maritime, 2014; Roads and Maritime, 2015) and took into consideration the following selection criteria:

- Located more than 50 metres from a waterway
- Located within or adjacent to land where the SSI is being carried out
- Have ready access to the road network
- Located to minimise the need for heavy vehicles to travel through residential areas
- Sited on relatively level land
- Separated from nearest residences by at least 200 metres (or at least 300 metres for a temporary batching plant)
- Not require vegetation clearing beyond that already required by the SSI
- Not impact on heritage items (including areas of archaeological sensitivity) beyond those already impacted by the SSI
- Not unreasonably affect the land use of adjacent properties
- Be above the 20 year ARI flood level unless a contingency plan to manage flooding is prepared and implemented
- Provide sufficient area for the storage of raw materials to minimise, to the greatest extent practical, the number of deliveries required outside standard construction hours.
Construction compound sites have been identified at locations as close as possible to the construction area, being on Aquatic Drive, Frenchs Forest and at the intersection of Warringah Road and Wakehurst Parkway (refer to Figure 5.13).

In the event that the ancillary site on the corner of Wakehurst Parkway and Warringah Road were to become the main compound site, the cumulative traffic and noise impacts from Stage 1 and 2 have been assessed accordingly in Chapters 7 and 8 of this EIS.

Alternative or additional sites may be identified during detailed design or at a later stage during construction. The selection of any additional or alternative site compounds or temporary stockpile sites would also be considered against the site selection criteria. Should these sites be located outside of the proposed construction impact area, additional environmental assessment would be carried out.

Use of the sites for Stage 2 Project construction activities would result in some potential additional impacts (above that assessed as part of the Stage 1 Project) for traffic and noise and vibration. Assessment of the potential impacts of Stage 2 Project construction traffic on local roads during the construction period is included in Section 7.3, and of potential noise impacts in Section 8.4.

5.3.7 Traffic management and access

Construction truck movements

Spoil removal and construction material deliveries would generate about 150 truck movements per day during peak periods of construction. An estimate of truck movements for the main spoil removal and material delivery activities is provided in Table 5.8.

Table 5.8 Estimated Average Daily Truck Movements

<table>
<thead>
<tr>
<th>Description</th>
<th>Average Number of Movements/Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spoil removal for Warringah Road westbound lanes</td>
<td>80</td>
</tr>
<tr>
<td>Concrete and architectural panels for Warringah Road</td>
<td>10</td>
</tr>
<tr>
<td>retaining walls</td>
<td></td>
</tr>
<tr>
<td>Concrete for piles</td>
<td>10</td>
</tr>
<tr>
<td>Steel cages for piles</td>
<td>5</td>
</tr>
<tr>
<td>Spoil removal from slot</td>
<td>80</td>
</tr>
<tr>
<td>Concrete for slot shotcrete</td>
<td>5</td>
</tr>
<tr>
<td>Architectural facing panels for slot</td>
<td>10</td>
</tr>
<tr>
<td>Intersection cover planks</td>
<td>20</td>
</tr>
<tr>
<td>Pedestrian deck units</td>
<td>5</td>
</tr>
<tr>
<td>Pavement materials</td>
<td>20</td>
</tr>
</tbody>
</table>

Note: 1- for every truck there is two truck movements – one to site and one from site

In addition to daily truck movements, there would be light vehicle movements associated with staff, labourers, subcontractors and small deliveries. This light vehicle traffic would generally be to and from the administration and support site compound and the work sites.
Impacts from construction traffic as a result of the Stage 2 Project is not considered to be substantial, given that Warringah Road currently carries up to 80,000 vehicles per day. However, localised impacts may occur in proximity to site access points for construction vehicles.

Designated access and haulage routes for construction vehicles entering and exiting the Stage 2 Project construction zones would be predominantly utilise the surrounding arterial road network where practicable, i.e. Warringah Road, Wakehurst Parkway and Forest Way. Surrounding local roads (e.g. Allambie Road) may also need to be utilised in conjunction with the arterial road network to provide for safe turnaround movements.

Construction traffic would predominantly travel between the compound site on Aquatic Drive to the Stage 2 Project construction work zones on Forest Way, Warringah Road, Wakehurst Parkway, and Allambie Road (refer to Section 5.4).

Access

There is potential for access to individual properties along the Stage 2 Project construction area and adjacent connecting roads to be affected by construction activities. Property access would be maintained throughout construction of the project, unless otherwise agreed with property owners and businesses, and any impacts would be short-term.

Traffic management plan

Construction activities would be guided by a construction environmental management plan to ensure work is carried out in accordance with the Secretary’s conditions of approval, and to Roads and Maritime specifications. A component of the CEMP would be a construction traffic management plan. Construction traffic would be managed in accordance with the measures outlined in the Roads and Maritime Traffic Control at Worksites (RTA, 2010) document and Roads and Maritime Specification G10 – Control of Traffic (RTA, 2006).

Traffic management measures to be implemented during construction would be determined during the detailed design and documented in the construction traffic management plan. A potential delivery scenario for Stage 2 Project construction is outlined in Section 5.4.1.

Typical traffic management measures carried out during construction would include, but not be limited to:

- Undertaking the proposed work in a staged manner to reduce traffic impacts
- Implementation of temporary speed restrictions within construction work zones
- Reduced lane widths within construction work zones
- Reduced shoulder widths and erection of traffic barriers along construction work zones
- Provision of appropriate warning and advisory signposting
- Provision of temporary access arrangements for private landowners whose property accesses are affected by construction activities
- Provisions for emergency services would also be included to ensure disruptions to access is minimised.

Consultation would be ongoing with Health Infrastructure (HI) during the construction period to ensure a coordinated approach is taken in regard to hospital construction traffic accessing the construction sites.
Local residents, schools and business owners would be notified of traffic management procedures, and ongoing consultation would be carried out to provide landowners with information on planned construction activities and changes to any access arrangements.

5.3.8 Workforce and construction work hours

Workforce

The construction workforce is expected to fluctuate, depending on the stage of construction and associated activities. The workforce would be expected to peak at about 120 personnel per day. On either side of this peak period, daily workforce numbers would fluctuate between about 40 and 60 personnel at any given time during the construction period. The final number of construction workers would be determined by the construction contractor.

Construction hours

The majority of construction work would be carried out in accordance with the Interim Construction Noise Guideline (DECCW, 2009) during standard working hours:

- 7am to 6pm Monday to Friday
- 8am to 1pm on Saturdays.

There would generally be no construction work on Sundays or public holidays, with the exception of those activities required to be carried out outside of standard construction hours.

A number of construction activities would also be required outside of standard construction hours to:

- Minimise unacceptable traffic disruptions to the road network
- Minimise disturbance to surrounding landowners and commercial properties
- Ensure the safety of the construction workers, motorists and the general public.

These activities would need to be carried out at night when traffic flows are lower to minimise disruption to traffic and potential safety risks to construction personnel and road users.

Laying of asphalt including milling and re-sheeting would be required at night when traffic flows are lower. This would minimise disruption to local traffic flows as the work would involve multiple traffic switches within a short period of time before traffic is allowed to use the completed sections of pavement.

Other out-of-hours construction activities and extended construction hours may be required to minimise disruption to daily traffic and disturbance to surrounding landowners and businesses. Activities listed in Table 5.9 are anticipated to be required, at times, to be performed out of hours.

**Table 5.9** Out-of-hours work activities and justification

<table>
<thead>
<tr>
<th>Activity</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completion of tie-ins and temporary diversions and traffic switches</td>
<td>Completing or installing these items at night when traffic flows on Warringah Road and Wakehurst Parkway would minimise disruption to traffic and minimise any potential safety conflict between construction personnel and traffic.</td>
</tr>
<tr>
<td>Activity</td>
<td>Justification</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Delivering large pre-cast concrete components, such as slot planks and deck units, and over-dimensioned plant and equipment</td>
<td>To minimise disruption to traffic flows.</td>
</tr>
<tr>
<td>Project support and site compound operation</td>
<td>Operation of the site compound would be required to support proposed out of hours work.</td>
</tr>
<tr>
<td>Erection of slot cover planks and deck units</td>
<td>During construction, the slot cover planks and deck units would be placed in close proximity to operating roadways. Due to the potential safety risks to road users and construction personnel associated with operating near the existing alignment, this work would need to be carried out outside peak traffic hours or at night when there are lower traffic flows. Avoiding peak periods would also minimise the disruption to traffic.</td>
</tr>
<tr>
<td>Erection of shared pedestrian/cyclist bridges</td>
<td>To minimise safety risks to local traffic and residents</td>
</tr>
<tr>
<td>Pavement work, temporary medians and linemaking</td>
<td>Pavement work would involve the milling and re-sheeting of asphalt overlay for existing roads, and full depth asphalt paving of the additional lanes on Warringah Road. While this work is to be completed in stages, they require lane closures and, in some cases, total closure of roads in order to safely carry out the work. This means that asphalt laying cannot be carried out during periods of high traffic volumes and would need to occur during even and night-time periods. Laying of asphalt at night would minimise disruption to local traffic flows as the work would involve multiple traffic switches within a short period of time before traffic is allowed to use the completed sections of pavement.</td>
</tr>
<tr>
<td>Refuelling operations and maintenance</td>
<td>To maximise the plant and machinery operations during the recommended standard hours, and thus reduce the overall duration of the project, refuelling operations of plant and machinery are proposed at:</td>
</tr>
<tr>
<td></td>
<td>• 5am to 7am Monday to Saturday or</td>
</tr>
<tr>
<td></td>
<td>• 6pm to 9pm Monday to Friday or</td>
</tr>
<tr>
<td></td>
<td>• 1pm to 9pm Saturday.</td>
</tr>
</tbody>
</table>

Transport for NSW’s Transport Management Centre (TMC) typically imposes strict requirements regarding night work, particularly over weekend periods. Although traffic volumes are lower, there is an increase in social behaviour on Friday and Saturday nights which presents potential safety issues for road users and construction personnel during night work within or adjacent to major roads such as Warringah Road. Subsequently, night work within or adjacent to major roads is typically preferred to be carried out on a Sunday night.

The construction contractor, Roads and Maritime and the TMC will work together to minimise construction activities on a Sunday night or early Monday morning as it is acknowledged that there is a need to balance TMC objectives with potential noise impacts to surrounding receivers.

Out of hours work may also be carried out where explicitly approved through an environment protection licence.
Where work is required outside standard working hours, measures would be implemented to
minimise noise and other types of disturbance to residents including but not limited to the
following:

- Notification to residents of any out-of-hours work
- Minimising the out-of-hours work in residential areas where possible
- Include respite periods in accordance with the ICNG
- Use of noise shielding for noisy equipment where feasible
- Undertaking noisy activities during daytime hours where reasonable and feasible.

Should work be required outside of the standard construction hours, the procedure contained in
Roadworks Outside of Normal Working Hours’ and the *Interim Construction Noise Guideline*
(ICNG) (DECCW 2010) would be followed. Refer to Section 8.4.6 for a noise and vibration
assessment of out of hours work. In addition, the safeguards outlined in Section 8.6 would be
followed. This would include notifying local residents prior to any construction activities carried out
outside of standard construction hours, respite periods and a complaints handling procedure.

### 5.3.9 Plant and equipment

A list of the indicative plant and equipment required for general construction activities including
numbers is provided in Table 5.10. The list is indicative of construction associated with the slot,
road embankments, drainage infrastructure and road pavement and may be subject to refinement
during detailed construction planning.

**Table 5.10** Indicative construction plant and equipment list

<table>
<thead>
<tr>
<th>Construction plant and equipment</th>
<th>Anticipated number of plant/equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 tonne piling rig</td>
<td>6</td>
</tr>
<tr>
<td>Excavators – 30 and 45-60 tonne</td>
<td>10</td>
</tr>
<tr>
<td>30 tonne dozer</td>
<td>2</td>
</tr>
<tr>
<td>Hydraulic hammer/ rockbreaker</td>
<td>1</td>
</tr>
<tr>
<td>Rock saw</td>
<td>1</td>
</tr>
<tr>
<td>Rockbolting rig</td>
<td>1</td>
</tr>
<tr>
<td>Sump pump</td>
<td>1</td>
</tr>
<tr>
<td>Mobile cranes – 50 and 80 tonne</td>
<td>6</td>
</tr>
<tr>
<td>150-200 tonne crane</td>
<td>1</td>
</tr>
<tr>
<td>Grader</td>
<td>6</td>
</tr>
<tr>
<td>Water cart</td>
<td>6</td>
</tr>
<tr>
<td>Smooth drum vibrating roller</td>
<td>6</td>
</tr>
<tr>
<td>Backhoe</td>
<td>6</td>
</tr>
<tr>
<td>Construction plant and equipment</td>
<td>Anticipated number of plant/equipment</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>Bogie tipper truck</td>
<td>26</td>
</tr>
<tr>
<td>Concrete agitator delivery trucks</td>
<td>17</td>
</tr>
<tr>
<td>Elevating work platform</td>
<td>6</td>
</tr>
<tr>
<td>Asphalt paving machine</td>
<td>5</td>
</tr>
<tr>
<td>Line marking machine</td>
<td>5</td>
</tr>
<tr>
<td>Kerb laying machine</td>
<td>5</td>
</tr>
<tr>
<td>Air compressor (250cfm)</td>
<td>3</td>
</tr>
<tr>
<td>Lighting plants</td>
<td>7</td>
</tr>
<tr>
<td>Road sweeper</td>
<td>2</td>
</tr>
</tbody>
</table>

It has been assumed that during each component of construction, the required plant and equipment such as vibrating and static rollers and excavators would be kept on site at the designated compound site.

The exact timing and storage requirements for the indicative plant and equipment would be confirmed during detailed design.

5.3.10 Earthwork

The Stage 2 Project would involve earthwork at various locations within the construction impact area. Based on estimates drawn from the concept design, it is estimated that about 180,000 cubic metres of material would be excavated. The Warringah Road surface lane construction would require around 7500 cubic metres of fill that would be reused from the cut material if suitable. Final cut and fill volumes would be confirmed during detailed design.

Fill embankments and shallow cut batters would be vegetated with native trees, shrubs and groundcovers consistent with the landscape framework detailed in Appendix G.

The estimated quantities of materials for import, re-use and disposal would be refined during detailed design and the development of the construction methodology by the construction contractor.

Should groundwater be encountered during earthwork, it would be managed in accordance with the management measures provided in Section 17.6.

5.3.11 Spoil and waste disposal

Spoil

The majority of spoil would be generated from the excavation of the slot. Based on the concept design, the Stage 2 Project would generate around 180,000 cubic metres of spoil. Anticipated volumes are shown in Table 5.11. Where practicable, and where the material is suitable, excavated material would be reused on site in the construction work. Surplus spoil would be progressively removed from site in trucks and transported to an approved reuse or waste site.
Contaminated soil from the demolition of the service station on the corner of Warringah Road and Hilmer Street would be taken to an appropriately licenced waste facility.

Spoil reuse and disposal locations would be chosen based on the type of material being removed from site, timing and with the aim of minimising the transport distance.

A number of potential sites have been identified with the capacity to receive the spoil generated by the Stage 2 Project, including:

- The ADI site, St Marys
- Gosford Quarry
- The CSR Quarry
- The Defence precinct Schofields (HMAS Nirimba)
- The Great Southern Rock Quarry Sandy Point.

Spoil would generally be transported off site during normal construction hours, however, there may be some activities (e.g. out of hours excavation work) where it is not feasible and/or reasonable to do so. In these cases spoil would be transported outside of normal construction hours via the most direct route using arterial roads wherever possible.

<table>
<thead>
<tr>
<th>Site</th>
<th>Anticipated spoil volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slot construction</td>
<td>125,000 cubic metres</td>
</tr>
<tr>
<td>Warringah Road (westbound)</td>
<td>55,000 cubic metres</td>
</tr>
<tr>
<td>Total</td>
<td>180,000 cubic metres</td>
</tr>
</tbody>
</table>

A plan for the site-specific management of materials would be prepared by the construction contractor prior to the commencement of relevant site work. The plan would ensure that spoil is properly managed during construction in a way that it is consistent with the principles of reduction, reuse and recycling.

Waste disposal

Roads and Maritime would endeavour to manage waste in order to conserve resources and reduce impacts associated with waste disposal for the Stage 2 Project.

The POEO Act, the Protection of the Environment Operations (Waste) Regulation 2005 and the hierarchy prescribed in the Waste Avoidance and Resource Recovery Act 2001 (WARR Act) are the key pieces of legislation that regulate waste in NSW. They contain the requirements for managing, storing, transporting, processing, recovering and disposing of waste.

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).

Proposed construction activities would create a number of waste streams generating volumes of waste that require a coordinated management process.
Waste streams would be generated during construction of the Stage 2 Project, including the following:

- Waste from existing structures that require demolition, there is potential for asbestos to be found in the buildings
- Excavated soil and rock which is unable to be reused within backfilling or restoration would be disposed of in accordance with the WARR Act
- Contaminated soils that may be exposed during construction, and if exposed, would require suitable off-site disposal (refer to Section 15.2.7)
- Groundwater from the slot
- Surplus material from construction and general site reinstatement, 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 generated by onsite personnel, such as paper, cardboard, beverage containers and food wastes
- Sewage waste generated through the use of personnel facilities.

A plan for the site-specific management of materials would be prepared by the construction contractor prior to the commencement of relevant site work. The plan would ensure that wastes are properly managed during construction in a way that it is consistent with the principles of avoidance, reduction, reuse and recycling.

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

- Transfer to other Roads and Maritime projects for reuse in accordance with the EPA’s excavated public road resource recovery exemption
- Transfer to an approved Roads and Maritime stockpile site for reuse on a future project only if a specific project has been identified prior to stockpiling and POEO Act waste regulatory requirements are met. If a project cannot be identified the material would not be stockpiled
- Transported off site for reuse by a third party in accordance with relevant EPA resource recovery exemption or to an EPA licensed waste recovery facility
- Disposal at an accredited materials recycling or waste disposal facility.

A description of each waste stream, the expected quantities of waste materials generated (where known), and management measures for waste material applicable to the Stage 2 Project are detailed in Section 18.3.
5.4 Construction staging

5.4.1 Potential delivery scenario

The Stage 2 Project would be delivered in a single construction program, commencing in early 2016 with construction completion planned for by mid-2018 based on a dry weather program. All work is scheduled to be completed in time for the opening of the hospital which is planned for late 2018. An indicative strategy for construction staging has been developed that aims to maintain the existing road capacity during construction, to minimise the number of traffic switches required, and maximise the amount of construction achievable under the existing traffic layout.

To gain access to construct the slot, the existing westbound lanes of Warringah Road would be relocated south onto the proposed permanent alignment of the westbound surface lanes. Construction of the new Warringah Road westbound lanes would be carried out off-line and would include the installation of retaining walls and permanent noise barriers for identified impacted properties.

Following completion of the road widening on the southern side of Warringah Road, the westbound traffic would be moved from the existing road alignment to the new lanes. This would allow access to the central work zone where the slot would be constructed.

Access to intersections at Fitzpatrick Avenue East, Hilmer Street, Bantry Bay Road, Rodborough Road and Allambie Road are expected to be impacted during construction of the new permanent westbound lanes. These impacts may include short term closures and detours during out of standard work hour activities (e.g. for the delivery of oversized pre-cast materials). Access to properties would be maintained.

Warringah Road (eastbound) traffic would remain on its existing alignment on the northern side of Warringah Road for the duration of construction. Temporary lane closures would be required on Warringah Road for certain activities. These work would be performed out of peak hours and may occur at night and/or on weekends and only following prior approval from the Transport for NSW Transport Management Centre (refer to Section 5.3.8).

Other key traffic changes would be associated with the intersection work where Warringah Road meets Forest Way, Hilmer Street and Wakehurst Parkway. Turning traffic at these intersections would be moved at the start of intersection work to allow half of the slot cover at each location to be constructed. Turning traffic would then be relocated onto the partially completed cover to enable the second half of the cover to be built. Once the cover has been completed, the turning traffic would be switched to its final permanent configuration. The cover may be constructed in more than one stage, requiring additional interim traffic arrangements.

In general, all current traffic movement functionality at the intersections would be maintained during the construction work. Short term temporary detours may be required out-of-hours (refer to Section 5.3.8).

In addition to the major traffic switches described above, there would be a series of traffic changes and traffic management measures for work including but not limited to:

- Aquatic Drive intersection construction
- Widening of Wakehurst Parkway south of Warringah Road.
Whilst the potential delivery scenario outlined above provides an indicative sequencing of work, there are no hard links between completion of one phase and commencement of the next. There are many construction elements of the Stage 2 Project which can be commenced largely independent of one another. The final staging methodology for the project would be refined in consultation with Health Infrastructure contractors and determined during the detailed design and construction planning phases (refer to Section 5.4.2).

5.4.2 Construction coordination mechanisms

Roads and Maritime together with Health Infrastructure have formed an interface reference group to provide a planning interface for the design development and subsequent construction of both the Northern Beaches Hospital Project and the Concept Proposal (including each associated stage). The interface group has met regularly since mid-2013 and will continue to meet through to delivery of the Northern Beaches Hospital Project.

The group’s purpose is to ensure an integrated approach is taken to both projects with respect to planning and delivery. The group works to co-ordinate design activities of the respective projects, ensuring an integrated and holistic solution is developed to deliver both projects in a structured and co-ordinated manner.

An interface agreement has been prepared and agreed between Health Infrastructure and Roads and Maritime. The interface agreement identifies an agreed set of principles to guide how the two projects would interact, particularly during the construction phases.
6 Consultation

This Section provides an overview of the consultation activities that have been, and will continue to be, carried out for the Stage 2 Project.

<table>
<thead>
<tr>
<th>Secretary’s Environmental Assessment Requirements</th>
<th>Where addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>During the preparation of the EIS, you must consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected land owners.</td>
<td>Section 6.2 Section 6.3 and Section 6.4</td>
</tr>
<tr>
<td>Local, State and Commonwealth government authorities, including the:</td>
<td>Section 6.1</td>
</tr>
<tr>
<td>• Environment Protection Authority</td>
<td></td>
</tr>
<tr>
<td>• Office of Environment and Heritage (including Heritage Division)</td>
<td></td>
</tr>
<tr>
<td>• Department of Primary Industries</td>
<td></td>
</tr>
<tr>
<td>• NSW Health (including Health Infrastructure)</td>
<td></td>
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<tr>
<td>• The Forest High School and Frenchs Forest Public School</td>
<td></td>
</tr>
<tr>
<td>• Department of Education and Communities</td>
<td></td>
</tr>
<tr>
<td>• NSW Police</td>
<td></td>
</tr>
<tr>
<td>• Ausgrid</td>
<td></td>
</tr>
<tr>
<td>• Warringah Council.</td>
<td></td>
</tr>
<tr>
<td>Specialist interest groups, including Local Aboriginal Land Councils, Aboriginal stakeholders, and pedestrian and bicycle user groups;</td>
<td>Section 6.2.1 and Section 6.3.1</td>
</tr>
<tr>
<td>Utilities and service providers;</td>
<td>Section 6.4.1</td>
</tr>
<tr>
<td>The public, including community groups (including any groups associated with the educational establishments in the proposal area) and adjoining and affected land owners.</td>
<td>Section 6.4.2</td>
</tr>
<tr>
<td>The EIS must describe the consultation process and the issues raised, and identify where the design of the proposal has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.</td>
<td>Section 6.3 and Section 6.4 Appendix F</td>
</tr>
</tbody>
</table>

6.1 Introduction

The NSW Government announced its intention to build a new hospital (the Northern Beaches Hospital) at the intersection of Warringah Road and Wakehurst Parkway, Frenchs Forest on 2 May 2013. The delivery of the hospital and the road network requires a coordinated approach by Government, which will be achieved through an already established interagency group. This group includes:

- Health Infrastructure, part of Health NSW is responsible for the delivery of the Northern Beaches Hospital
- Department of Planning and Environment, which is exploring how the surrounding area could play a role in supporting the hospital development
- Roads and Maritime, the delivery arm of Transport for NSW, is responsible for providing a road network solution – being the Concept Proposal and its associated stages
• Warringah Council, the local government authority for Frenchs Forest and surrounding suburbs, will work with Roads and Maritime to manage the increased demand for parking that is likely to follow the completion of the hospital.

This Section discusses the consultation carried out to date for the Stage 2 Project and consultation proposed for the future. The consultation objectives and strategy are described, with the outcomes of consultation with the community, the Aboriginal community, and relevant government agencies and stakeholders provided.

6.2 Consultation objectives and strategy

Roads and Maritime considers that meaningful and engaging community consultation is an essential component of the Stage 2 Project. A Communications and Engagement Strategy (Roads and Maritime, January 2014) has been prepared which outlines how Roads and Maritime will consult and communicate with the local community and key stakeholders.

Communication and engagement objectives include:

• Provide regular and timely information to community and stakeholders
• Provide clear and concise information about when feedback is sought from the community and stakeholders and what they can comment on
• Ensure impacts on community members and stakeholders are evaluated and this information is then considered both in the Stage 2 Project design and in planning for future consultation activities
• Work with partners to ensure consistent messaging to help avoid confusion for the community and stakeholders
• Be consistent with the SEARs issued for the Stage 2 Project on 10 September 2014 and supplementary SEARs issued 18 May 2015.

6.3 Consultation process and activities to date

6.3.1 Stakeholder identification

Stakeholders were identified from consideration of the Stage 2 Project’s potential direct and indirect impacts and from records of past and current contact with relevant government bodies, stakeholders and interest groups.

Stakeholders were grouped into the following categories:

• Potentially directly affected property owners, including adjoining land owners
• Interest groups, such as community and business owners and business groups
• The Local Aboriginal Land Councils
• Government and non-government agencies
• The broader community.

A list of stakeholder groups that have been consulted is provided in Table 6.1.
Table 6.1 Stakeholder groups

<table>
<thead>
<tr>
<th>Stakeholder group</th>
<th>Stakeholder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government stakeholders</td>
<td>• Transport for NSW</td>
</tr>
<tr>
<td></td>
<td>• Health Infrastructure of NSW Health</td>
</tr>
<tr>
<td></td>
<td>• NSW Treasury</td>
</tr>
<tr>
<td></td>
<td>• NSW Department of Planning and Environment</td>
</tr>
<tr>
<td></td>
<td>• Office of Environment and Heritage (including Heritage Division)</td>
</tr>
<tr>
<td></td>
<td>• Environment Protection Authority</td>
</tr>
<tr>
<td></td>
<td>• NSW Department of Education and Communities</td>
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<tr>
<td></td>
<td>• Department of Premier and Cabinet</td>
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<td></td>
<td>• NSW Department of Primary Industries</td>
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<tr>
<td></td>
<td>• NSW Office of Water</td>
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<td></td>
<td>• Northern Beaches Health Service Redevelopment</td>
</tr>
<tr>
<td></td>
<td>• Ausgrid, Telstra, Sydney Water, Jemena, Optus, NBN – utility authorities</td>
</tr>
<tr>
<td>Commonwealth electorates</td>
<td>• Australian Electorate of Warringah</td>
</tr>
<tr>
<td></td>
<td>• Australian Electorate of Mackellar</td>
</tr>
<tr>
<td>State electorates</td>
<td>• State MP: Wakehurst</td>
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<tr>
<td></td>
<td>• State MP: Manly</td>
</tr>
<tr>
<td></td>
<td>• State MP: Pittwater</td>
</tr>
<tr>
<td></td>
<td>• State MP: Willoughby</td>
</tr>
<tr>
<td></td>
<td>• State MP: North Shore</td>
</tr>
<tr>
<td>Local government</td>
<td>• Warringah Council</td>
</tr>
<tr>
<td></td>
<td>• Manly Council</td>
</tr>
<tr>
<td></td>
<td>• Pittwater Council</td>
</tr>
<tr>
<td></td>
<td>• Mosman Council</td>
</tr>
<tr>
<td></td>
<td>• North Sydney Council</td>
</tr>
<tr>
<td>Business</td>
<td>• Rotary Club of Frenchs Forest</td>
</tr>
<tr>
<td></td>
<td>• Business owners on Warringah Road and Forest Way</td>
</tr>
<tr>
<td></td>
<td>• Industries along Forest Way, Warringah Road and Aquatic Drive</td>
</tr>
<tr>
<td></td>
<td>• Warringah Chamber of Commerce and Industry</td>
</tr>
<tr>
<td>Aboriginal groups</td>
<td>• Guringhai people, the traditional owners of this area</td>
</tr>
<tr>
<td></td>
<td>• Aboriginal Heritage Office</td>
</tr>
<tr>
<td></td>
<td>• Metropolitan Local Aboriginal Land Council</td>
</tr>
<tr>
<td>Community action groups</td>
<td>• HEAL Northern Beaches</td>
</tr>
<tr>
<td></td>
<td>• Duffys Defenders (Warringah Council)</td>
</tr>
<tr>
<td></td>
<td>• Northern Beaches Roadkill Prevention Committee</td>
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<tr>
<td></td>
<td>• Frenchs Forest South Residents’ Action Group</td>
</tr>
<tr>
<td></td>
<td>• TrailCare (advocacy group representing mountain bikers)</td>
</tr>
<tr>
<td>Stakeholder group</td>
<td>Stakeholder</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------</td>
</tr>
</tbody>
</table>
| **Education**     | • Frenchs Forest Public School  
|                   | • The Forest High School  
|                   | • Davidson High School  
|                   | • Arranounbai School  
|                   | • St Martin de Porres Catholic Primary School  
|                   | • Mimosa Public School  
|                   | • Wakehurst Public School |
| **Transportation**| • Australian Trucking Association  
|                   | • Bus operators  
|                   | • Sydney Buses |
| **Emergency services** | • NSW Police Service  
|                      | • Fire Brigade  
|                      | • Ambulance Service  
|                      | • Emergency Services  
|                      | • Rural Fire Control  
|                      | • Rural Fire Service – Communications Group  
|                      | • NSW Rural Fire Service |
| **Community members** | • Affected property owners, including adjoining land owners  
|                       | • Interested residents who have made inquiries and are now on the registered stakeholder list  
|                       | • Residents within the Concept Proposal distribution zone  
|                       | • Pedestrian user groups  
|                       | • Bicycle user groups  
|                       | • Motorists using the roads |
| **Secondary stakeholders** | • The community likely to be interested in the development of the hospital includes the North Shore and Northern Beaches area of Sydney. It incorporates the following NSW State electorates:  
|                            | − Wakehurst electorate  
|                            | − Manly electorate  
|                            | − Pittwater electorate  
|                            | − North shore electorate  
|                            | − Willoughby electorate |
6.3.2 Main consultation activities

Communication and consultation tools

Community and stakeholder consultation and information will be provided on a regular basis. The following is a summary of the communication and consultation tools established for use across the life of the Concept Proposal (and its associated stages):

- Community information contact line (1300 367 459)
- Project email (nbhroadwork@rms.nsw.gov.au)
- Project database to record all correspondence relevant to the project, including contact details and issues raised during the life of the project
- Registered stakeholder database
- Community information sessions
- Meetings with key stakeholders
- Face-to-face meetings with individual owners/residents of properties that may be directly affected by the project
- Community update newsletters
- Letterbox drops
- Mail-outs (addressed and un-addressed)
- Door knocking within the immediate Concept Proposal areas
- Feedback form
- Media releases, print and broadcast media advertising
- Advertisements in the local press for community information sessions and EIS display
- Variable message signs
- Video animation.

Consultation activities – March 2014 to August 2014

Consultation activities were carried out from March to April 2014 and again in July and August 2014. The aim of consultation was to inform the community and key stakeholders about the project, the planning approval process and next steps and to encourage their feedback at our forums and via written submissions. Consultation activities included:

- Door knocking:
  - Over 500 potentially affected properties (14 to 18 March 2014)
  - 42 potentially affected properties including businesses (week commencing 21 July 2014).
- Community updates were distributed to:
  - 20,000 residents and businesses to make them aware of the project (week commencing 17 March 2014)
- 20,000 residents and businesses to promote upcoming community information sessions (week commencing 31 March 2014)
- 1500 residents and businesses located within the Concept Proposal specialist study areas during to make them aware of upcoming environmental investigations (week commencing 31 March 2014)
- 4000 residents and businesses to raise awareness of the community information session (11 April 2014)
- 20,000 residents to promote upcoming community information sessions (23 July to 25 July 2014)
- Flyer to 7,000 residents to encourage attendance at the pop up display at Belrose SupaCenta.

- Nine press ads placed in the Manly Daily to raise awareness of consultation and information sessions
- Community information sessions held at:
  - Forestville and Frenchs Forest on 7, 8 and 12 April 2014. Over 700 people attended the sessions
  - Forestville, Frenchs Forest, Mona Vale and Manly on 26, 28 and 30 July and 2, 7 and 16 August. Over 650 people attended the sessions
  - Shopping centre display was held on 31 July at the Belrose SupaCenta.

- Meetings with key stakeholders including Council, stakeholders, community groups, potentially affected property owners. Ongoing monthly meetings with The Forest High School working group
- Two community consultation reports were published for the early consultation period in March/April 2014 and again for the consultation on the Stage 1 Project concept design and the Stage 2 Project schematic layout in July/August 2014.

6.3.3 Consultation activities – Exhibition of the EIS Stage 1 and Concept Proposal

The EIS Stage 1 Project and Concept Proposal was advertised and placed on display from 22 October 2014 until 21 November 2014. Community information sessions and stakeholder/community meetings were held during the display to enable community representatives to ask questions and to provide further information for consideration in the assessment process. During the EIS exhibition, the community, government agencies and other interested parties were invited to make written submissions on the EIS Stage 1 Project and Concept Proposal to the Department of Planning and Environment. Consultation activities included:

- The EIS Stage 1 Project and Concept Proposal was available for viewing at the following locations:
  - Nature Conservation Council – Level 2, 5 Wilson Street, Newtown
  - Belrose Library, Glenrose Place, Belrose
  - Forestville Library, 9 Darley Street, Forestville
  - Warringah Council, 725 Pittwater Road, Dee Why
- Dee Why Library, 725 Pittwater Road, Dee Why
- Warringah Mall Library, Shop 650, 2nd Floor, Warringah Mall, 145 Old Pittwater Road, Brookvale
- Department of Planning and Environment, Information Centre, 23-33 Bridge Street, Sydney
- Roads and Maritime Services (Head Office), Level 9, 101 Miller Street, North Sydney.
- Door knocking of the directly affected residential properties, business and property owners and tenants (week commencing 3 November 2014)
- A community update was distributed to 20,000 residents and businesses to make them aware of the EIS exhibition period (week commencing 20 October 2014) and published on the project web page
- An overview of the EIS Stage 1 Project and Concept Proposal was published on the project web page and made available at the community information sessions and the display locations
- Three press ads placed in the Manly Daily to raise awareness of the EIS exhibition and information sessions
- Two community information sessions were held at Forestville and Frenchs Forest on 8 and 11 November 2014. Over 100 people attended the sessions
- Meetings with key stakeholders including Council, stakeholders, community groups, potentially affected property owners. Ongoing monthly meetings with The Forest High School working group
- A briefing for business owners, tenants and residents directly impacted by the Stage 2 Project was held on 27 November 2014
- A preferred infrastructure report was developed following the exhibition of the EIS Stage 1 Project and Concept Proposal. The Secretary provided copies of submissions to Roads and Maritime and the submissions report was prepared to respond to the issues raised during the exhibition period which was included within the preferred infrastructure report.

6.3.4 Consultation activities – Preliminary concept design for Stage 2 Project

Following extensive community consultation and careful consideration of the alternative options and potential impacts, the decision was made by government to proceed with an east-west road underpass and widening on the southern side of Warringah Road to improve capacity and reduce congestion as part of the Stage 2 Project work for the Northern Beaches Hospital Road Connectivity and Network Enhancement project. A preliminary concept design, video animation and Options Development and Selection Report were developed to inform the community and key stakeholders about the project and the next steps. Consultation activities included:

- A community update was published on the project web page during the week commencing 15 December 2014 and distributed to 20,000 residents and businesses during the week commencing 12 January 2015
- A Northern Beaches Hospital Road Connectivity and Network Enhancement Project Options Development and Selection Report (Roads and Maritime, December 2014) was prepared to provide information on the option selection approach and the other options explored. The report was published on the project web page during the week commencing 15 December 2014 and copies were distributed to directly impacted property owners, businesses, tenants and key stakeholders
• A video animation was prepared for Stage 1 and Stage 2 Projects of the Northern Beaches Hospital Road Connectivity and Network Enhancement project and published on the project web page during the week commencing 15 December 2014. To date the video animation has had almost 20,000 views

• Meetings with key stakeholders including Council, stakeholders, community groups, potentially affected property owners. Ongoing monthly meetings with The Forest High School working group.

6.4 Summary of issues raised

Issues identified during the consultation process for the Stage 2 Project by government agencies, local government, the community, Local Aboriginal Land Council and special interest groups have informed this EIS and the ongoing development of the project. A summary of these issues and the locations in the EIS where they are addressed is included below.

6.4.1 Issues raised by government agencies

A list of government agencies, including local government, consulted over the course of the Stage 2 Project and during the preparation of this EIS, and their key issues and requirements are detailed in Table 6.2. The table also identifies the section of this EIS that addresses each issue.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Details</th>
<th>EIS Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements of biodiversity offsets to be secured prior to construction</td>
<td>A biodiversity impact assessment was carried out for the Stage 1 Project. Assessments of significance were carried out for impacts to Duffy’s Forest EEC and threatened species listed under the TSC Act and EPBC Act. The removal of Duffy’s Forest EEC (5.1 ha for the Concept Proposal and 1.2 ha for Stage 1 Project) is considered significant largely because there is less than 16 per cent of the original area remaining in the area as fragmented patches (NPWS 2004). Impacts to Duffy’s Forest EEC would be offset in accordance with the proposed offset strategy (refer to Appendix E. This strategy provides for offsetting residual significant impacts in a manner that is consistent with the NSW offset principles for major projects (OEH 2013). Roads and Maritime and Warringah Council are working together to identify potential biodiversity offset sites within the Warringah LGA. While every effort would be made to secure biodiversity offset sites prior to construction this may not be achievable. Roads and Maritime would continue to consult with Warringah Council and OEH on offset sites to ensure the objectives of the offset strategy are achieved in a suitable timeframe and cost.</td>
<td>Section 9.6</td>
</tr>
</tbody>
</table>
**Northern Beaches Hospital Road Connectivity and Network Enhancements – Stage 2 Environmental Impact Statement**

**Roads and Maritime Services**

<table>
<thead>
<tr>
<th>Issue</th>
<th>Details</th>
<th>EIS Section</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Warringah Council</strong></td>
<td>Roads and Maritime has considered a number of design options that would constitute the Stage 2 Project work. One of the options considered involved the provision of an overpass for east-west traffic on Warringah Road over Wakehurst Parkway. This option would have resulted in the Hilmer Street ingress/egress to/from Warringah Road being limited to left in/left out only. In addition Roads and Maritime would have also needed to consider connecting Fitzpatrick Avenue East to Wakehurst Parkway. The preferred design option for Stage 2 Project work involves an underpass which makes allowance for all current movements to/from Hilmer Street and Warringah Road to be maintained.</td>
<td>Section 1</td>
</tr>
<tr>
<td><strong>Impacts to the environment in particular endangered ecological communities</strong></td>
<td>Roads and Maritime would ensure that impacts to the environment are minimised in particular Duffys Forest EEC. The construction impact area has been reduced as much as possible by designing roadwork from the existing road pavement out. The construction impact area has been reduced from 15 metres down to five metres in specific locations. Alternative techniques for creating earth cuttings are being considered to also reduce the impact as much as possible on Duffys Forest EEC. Roads and Maritime and Warringah Council are working together to identify potential biodiversity offset sites for Duffys Forest EEC within the LGA.</td>
<td>Section 9.6</td>
</tr>
<tr>
<td><strong>Impacts to stormwater drainage</strong></td>
<td>Roads and Maritime has carried out a hydrology assessment as indicated in Section 16. The strategy developed by Roads and Maritime aims to mitigate the adverse impacts of the road upgrade work on existing drainage system in terms of quantity and quality. This has been discussed with Warringah Council and there is general agreement in principle that the proposed measures are satisfactory.</td>
<td>Section 16</td>
</tr>
<tr>
<td><strong>Carrying out archaeological test excavations at the former Brickworks site to gain a better understanding of the potential significance</strong></td>
<td>As concluded in the SoHI (refer to Appendix I), the potential for finding archaeological evidence associated with the former built structures of Hews’ Brickworks operation is considered to be low. As such the Roads and Maritime Standard Management Procedure: Unexpected Archaeological Finds is considered adequate to manage any potential construction impacts to potential historical archaeological evidence during Stage 2 construction.</td>
<td>Section 13.4</td>
</tr>
<tr>
<td><strong>Department of Education and Communities, on behalf of The Forest High School</strong></td>
<td>Roads and Maritime has identified The Forest High School as a key stakeholder. A working group has been established that involves representatives of The Forest High School, Roads and Maritime and Health Infrastructure to ensure that as the Stage 2 Project develops the safety of students, staff and visitors to the school is considered carefully and that appropriate strategies are put in place in consultation with school representatives.</td>
<td>Section 5.3.4</td>
</tr>
<tr>
<td>Issue</td>
<td>Details</td>
<td>EIS Section</td>
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<tr>
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</tr>
<tr>
<td>Impacts of construction to the learning environment</td>
<td>The Forest High School, Roads and Maritime and Health Infrastructure working group would ensure that the impacts to the learning environment of The Forest High School due to construction of both the Stage 2 Project and hospital are minimised. Roads and Maritime would consider scheduling particularly noisy activities outside normal working hours, where possible.</td>
<td>Section 8.4</td>
</tr>
<tr>
<td>The need for safe and appropriate public transport measures including working with the school and local bus operators regarding the routes and bus stops</td>
<td>Roads and Maritime, Transport for NSW and The Forest High School have worked closely together during the design development of the Stage 2 Project. Public transport provisions have been incorporated within the scope of the Stage 2 Project work.</td>
<td>Section 7.4</td>
</tr>
<tr>
<td>Transport for NSW</td>
<td>Roads and Maritime and Transport for NSW have worked closely together to develop bus priority measures within the scope of the work (primarily Stage 1 Project) in accordance with the principles of Sydney Bus Futures. Work including bus lanes on Frenchs Forest Road on approach to and departure from the Wakehurst Parkway intersection, extended bus bays and removal of roundabouts on Frenchs Forest Road are proposed as part of Stage 1 Project work. Bus travel time assessment through the road corridor has been carried out based on the changes proposed to bus stop locations as supplied by Transport for NSW.</td>
<td>Section 3.1.7</td>
</tr>
<tr>
<td>SHOROC (Shore Regional Organisation of Councils)</td>
<td>Sydney Bus futures and the Northern Beaches Transport Action Plan have indicated that Warringah Road has not been nominated as a potential route for bus rapid transit. Rather Warringah Road and Frenchs Forest Road between Dee Why and Chatswood have been designated as a ‘suburban bus corridor’. A suburban bus corridor results in bus priority measures being provided at the approach and departure to major intersections to ensure that bus travel speeds and reliability targets are met. Bus priority measures in accordance with the principles of Sydney Bus futures have been incorporated within the scope of the Concept Proposal and Stage 1 Project. While Warringah Road has not been identified for bus rapid transit provisions the Concept Proposal provides suitable capacity to cater for road based public transport.</td>
<td>Section 3.1</td>
</tr>
<tr>
<td>Department of Primary Industries (DPI)</td>
<td>No issues raised during consultation</td>
<td></td>
</tr>
</tbody>
</table>
### NSW Health (Health Infrastructure)

<table>
<thead>
<tr>
<th>Issue</th>
<th>Details</th>
<th>EIS Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction access</td>
<td>Need to ensure construction of Stage 2 does not affect construction access to the hospital site</td>
<td>Section 7.3</td>
</tr>
<tr>
<td>Coordination</td>
<td>Roads and Maritime and Health Infrastructure have developed an interface agreement which identifies technical requirements related to traffic management and access during construction of the projects.</td>
<td>Section 7.3</td>
</tr>
</tbody>
</table>

### Emergency services

<table>
<thead>
<tr>
<th>Issue</th>
<th>Details</th>
<th>EIS Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambulance access</td>
<td>No concerns about accessing the hospital due to traffic congestion.</td>
<td>Section 7.4</td>
</tr>
<tr>
<td>Project information</td>
<td>The local Fire Brigade requested regular project updates through the project database (this has been actioned).</td>
<td></td>
</tr>
</tbody>
</table>

### 6.4.2 Issues raised by the community

Issues raised by community members and local businesses during the consultation process are detailed in Table 6.3. The table also identifies the section of this EIS that addresses each issue.

#### Table 6.3 Issues raised by the community

<table>
<thead>
<tr>
<th>Issue</th>
<th>Consideration</th>
<th>EIS Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclists and pedestrians</td>
<td>Provision for cyclists in the Concept Proposal. The community are unclear where the pedestrian bridge would be located on Warringah Road. Provision for pedestrian crossings for school students.</td>
<td>Section 5.1.4</td>
</tr>
<tr>
<td>Traffic congestion</td>
<td>Existing congestion generally on the Northern Beaches, and specifically on Warringah Road, Wakehurst Parkway, and local roads of Frenchs Forest needs to be addressed as part of the Concept Proposal. The Concept Proposal should address both existing congestion and anticipated hospital traffic.</td>
<td>Section 3.1 and 3.2</td>
</tr>
<tr>
<td>Rat running</td>
<td>Strong opposition was communicated to investigations into opening Fitzpatrick Avenue to Wakehurst Parkway. Residents were concerned it would create a rat run through quiet local streets.</td>
<td>Section 10.4.5</td>
</tr>
<tr>
<td>Aquatic Drive connection to Wakehurst Parkway</td>
<td>Strong community support for left in left out on Aquatic Drive to Wakehurst Parkway to alleviate congestion in the industrial area.</td>
<td>Section 7.4</td>
</tr>
<tr>
<td>Issue</td>
<td>Consideration</td>
<td>EIS Section</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Grade separation</td>
<td>Strong community support for grade separation of Forest Way and Warringah Road, and Wakehurst Parkway and Warringah Road.  &lt;br&gt; Hilmer Street access should be retained.</td>
<td>Section 7.4</td>
</tr>
<tr>
<td>Property acquisition and adjustments</td>
<td>Impacts of property (strip or full) acquisitions along Frenchs Forest Road, Warringah Road, and in the vicinity of the retail/light industrial area adjacent to and between Bantry Bay Road and Hilmer Street, in particular those with long-term leases.  &lt;br&gt; Potential for impact to property values as a result of the Stage 2 Project.  &lt;br&gt; Timing of notification to property owners in Stage 2 area.</td>
<td>Section 5.1.13, 10.3, 6.3</td>
</tr>
<tr>
<td>Safety</td>
<td>Pedestrian bridges are preferred as a means of improving pedestrian safety and traffic flow.  &lt;br&gt; Long pedestrian ramps prove difficult for the mobility impaired to negotiate. Preference is for lifts where ramps are considered too long.</td>
<td>Section 7</td>
</tr>
<tr>
<td>The Forest High School</td>
<td>Concerns were raised by The Forest High School, the Parents and Citizens Committee, and community members over potential impacts to the school including:  &lt;br&gt; • Public transport provision  &lt;br&gt; • School access and parking (teachers, visitors, and on-street parking availability during drop off, pick up and school events)  &lt;br&gt; • Urban design and general amenity  &lt;br&gt; • Road and pedestrian safety  &lt;br&gt; • Property acquisition impacts  &lt;br&gt; • Construction and operational noise impacts  &lt;br&gt; • Air quality.  &lt;br&gt; Consideration should be given to removing the school zone on Warringah Road as it slows traffic and anecdotally students are not spotted accessing the Forest High School from Warringah Road.</td>
<td>Section 7.3 and 7.4, 7.3 and 7.4, 10.4, 10.3 and Section 7.3, 8.4 and Section 8.5, 14.3 and Section 14.4</td>
</tr>
<tr>
<td>Noise impacts</td>
<td>Increased noise impacts from additional traffic and traffic lanes being closer to the property boundary.  &lt;br&gt; Noise barriers should be considered for residences nearby the grade separated areas of Warringah Road.  &lt;br&gt; Noise attenuation should be considered to manage noise impacts to school students.</td>
<td>Section 8.4 and Section 8.5, 8.6</td>
</tr>
</tbody>
</table>
6.4.3  Issues raised by the special interest groups and service providers

Aboriginal community

Key issues were considered and identified by the Aboriginal community through an archaeological survey of the study area on Wednesday 9th, Thursday 10th and Friday 11th April 2014, and subsequently communicated through the Aboriginal stakeholder cultural heritage primary survey report (Metropolitan Local Aboriginal Land Council, April 2014) (refer to Appendix H).

Key issues raised in relation to the Stage 2 Project are detailed in Table 6.4. The table also identifies the section of this EIS that addresses each issue.

Table 6.4 Issues raised by the Metropolitan Local Aboriginal Land Council

<table>
<thead>
<tr>
<th>Issue</th>
<th>Details</th>
<th>EIS Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural heritage</td>
<td>No Aboriginal archaeological or cultural sites or areas of potential archaeological deposit were identified by the MLALC within the Stage 2 Project area.</td>
<td>Section 12</td>
</tr>
</tbody>
</table>

Pedestrian and bicycle user groups

Requirements for pedestrians and cyclists has been obtained through a consultative process with Warringah Council and TfSNW as part of the development of the concept design. There has also been various discussions with the Warringah Council traffic committee’s cycling representative regarding cycling provisions for both Stage 1 and Stage 2 of the project.

Utilities and service providers

Ausgrid, Telstra, Sydney Water, Jemina, Optus, Uecomm, Verizon, AJC, TPG, and NBN Co were each consulted during development of the project.

All utilities providers provided their preferred design requirements which will be integrated into the project. AJC and Verizon noted that their assets are deemed federally critical infrastructure, being linked via submarine cable connecting Australia to Japan and the USA.
In addition to consulting with the service providers, RMS has also consulted Health Infrastructure to allow for interface between services works on both projects such as sewer main, power, communication and gas.

6.5 Future consultation

6.5.1 Consultation and community involvement during the exhibition of the EIS

The EIS will be advertised and placed on public exhibition for a minimum of 30 days. The EIS will be available for viewing at the following locations:

- Nature Conservation Council – Level 2, 5 Wilson Street, Newtown
- Belrose Library, Glenrose Place, Belrose
- Forestville Library, 9 Darley Street, Forestville
- Warringah Council, 725 Pittwater Road, Dee Why
- Dee Why Library, 725 Pittwater Road, Dee Why
- Warringah Mall Library, Shop 650, 2nd Floor, Warringah Mall, 145 Old Pittwater Road, Brookvale
- Department of Planning and Environment, Information Centre, 23-33 Bridge Street, Sydney
- Roads and Maritime Services (Head Office), Level 9, 101 Miller Street, North Sydney

Community information sessions and stakeholder/community meetings will be held during the exhibition of the EIS Stage 2 to enable community representatives to ask questions and to provide further information for consideration in the assessment process. During the EIS exhibition, the community, government agencies and other interested parties are invited to make written submissions on the Stage 2 Project to the Department of Planning and Environment.

Three community information sessions will be held at the following locations:

- Saturday 25 July, 12pm to 2pm, Forestville Memorial Hall, Corner of Starkey Street and Warringah Road, Forestville
- Tuesday 28 July, 5pm to 7pm, Galstaun Function Centre, 5 Grattan Crescent, Frenchs Forest.

Saturday 1 August, 12pm to 2pm, Forestville Memorial, Hall Corner of Starkey Street and Warringah Road, Forestville.

Following the exhibition of the EIS, the Secretary will provide copies of submissions to Roads and Maritime or a report containing a summary of the issues raised. The Secretary may then require Roads and Maritime to prepare a submissions report to respond to the issues raised in submissions, and may require a preferred infrastructure report to outline any proposed changes to the Stage 2 Project. If significant changes to the Stage 2 Project are proposed, the Secretary may make the preferred infrastructure report publicly available.

The Secretary will prepare a Secretary’s environmental assessment report and provide it to the Minister for Planning. The Minister for Planning will then decide whether or not to approve the Stage 2 Project and the conditions to be attached.
6.5.2 Consultation following exhibition of the EIS

Roads and Maritime would continue to identify and manage issues of interest or concern to the community during the assessment and approval process and, if the Stage 2 Project is approved, during the detailed design process and construction. The aims of ongoing communications and consultation are to provide the community with:

- Accurate and accessible information regarding the processes and activities associated with the Stage 2 Project
- Information in a timely manner
- Appropriate avenues for providing comment or raising concerns, and to ensure they are aware of the avenues
- A high level of responsiveness to their issues and concerns throughout development and delivery of the Stage 2 Project.

6.5.3 Community involvement during construction

Community involvement would continue as part of construction of the Stage 2 Project. A community involvement plan would be developed by the construction contractor and implemented prior to Stage 1 Project construction (subject to approval), and updated prior to Stage 2 Project construction (subject to approval). This would set out the methods to be employed and stakeholders targeted as part of consultation and communication during construction.

Key involvement activities and tools would include:

- Development and implementation of a detailed construction communications plan
- Notification of work (including targeted letterbox drops)
- 24-hour project information phone line
- Variable Message Signs
- Complaints management process
- Regular updates to the project website
- Newsletters, information brochures and fact sheets
- Clear signage at construction sites
- Media releases and advertisements in local and metropolitan papers
- Construction updates (including for councils, emergency services and bus operators).
7 Traffic and transport

This section provides an assessment of traffic and transport issues for the Stage 2 Project as identified in the SEARs.

The assessment is supported by detailed investigations, which have been documented in the Traffic and Transport working paper (GTA, 2015a) in Appendix C.

The proposed management and mitigation measures in this section are collated in Section 21.

<table>
<thead>
<tr>
<th>Secretary’s Environmental Assessment Requirements</th>
<th>Where addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detailed assessment and modelling of operational traffic and transport impacts.</td>
<td>Section 7.4</td>
</tr>
<tr>
<td>This must consider:</td>
<td></td>
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<tr>
<td>- An assessment of impacts and/or benefits on the local and regional road network including in relation to and beyond those associated with the Northern Beaches Hospital, considering potential future land use patterns and intensification in the area detailed in regional planning documents;</td>
<td>Section 7.1.1</td>
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<td>Section 3.2</td>
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<tr>
<td>- Key intersections and the level of service/performance of intersections upstream and downstream of the project area.</td>
<td>Section 7.4</td>
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<tr>
<td>- Impacts on property and business access and on street parking provision, including permanent and temporary (construction) changes to access and parking</td>
<td>Section 7.3</td>
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<tr>
<td>- Operational implications for public transport (particularly with respect to strategic bus corridors and bus routes) and opportunities to improve public transport services and patronage, including the need to move or upgrade public transport infrastructure.</td>
<td>Section 7.4</td>
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<tr>
<td>- Safety and access impacts on road users (including cyclists and pedestrians) and consideration of opportunities to integrate cycleway and pedestrian elements with surrounding networks and attractors (existing and proposed). This should include impacts associated with The Forest High School and Frenchs Forest Public School, informed by surveys of traffic movements and mode distribution associated with the schools.</td>
<td>Section 7.4</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>Details assessment of construction traffic and transport impacts of the proposal (including ancillary facilities) and associated management measures, in particular:</td>
<td>Section 7.3</td>
</tr>
<tr>
<td>- Impacts to the road network (including safety and level of service, pedestrian and cyclist access, maintenance of construction access to the Northern Beaches Hospital site, and disruption to public transport services and access to properties);</td>
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<tr>
<td>- Impacts of potential shifts of traffic movements to alternative routes outside the proposal area;</td>
<td>Section 7.3</td>
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<tr>
<td>- Availability of on-street parking within and surrounding the project area;</td>
<td>Section 7.3</td>
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<td></td>
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</tr>
<tr>
<td>- Impacts to school related traffic (bus, service, emergency and private vehicles) both on-site and on-street, and pedestrian and cycle movements;</td>
<td>Section 7.3</td>
</tr>
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<td></td>
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<tr>
<td>- Route identification and scheduling of transport movements, including movements to transport spoil;</td>
<td>Section 7.3</td>
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<td></td>
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<tr>
<td>- The number, frequency and size of construction related vehicles (both passenger, commercial and heavy vehicles);</td>
<td>Section 7.3</td>
</tr>
</tbody>
</table>
7.1 Assessment methodology

A detailed description of the traffic and transport assessment methodology is provided in the traffic and transport working paper included as Appendix C.

7.1.1 Operational traffic and transport

Traffic modelling for the Stage 2 Project used the VISSIM micro-simulation software package. The micro-simulation model was initially developed by Roads and Maritime to evaluate various potential options for the Concept Proposal as part of the options development process. It is based on updated future population and employment land use scenarios developed by the Bureau of Transport Statistics.

The micro-simulation model was refined and updated to reflect more recent information. This included expanding the peak hour model periods to capture anticipated traffic generation patterns of the hospital and the adjacent The Forest High School outside the typical peak periods. This expanded time period was adopted to cover the start and end of the day time shift at the hospital (7am to 3:30pm) and also the end of the school day at 3pm.

Other refinements to the model include the adoption of a revised commuter distribution for 2028. This is because over the ten years after opening in 2018, a larger proportion of staff are expected to live closer to the hospital and to the west of the hospital than currently in 2018 when staff would largely be relocating from Mona Vale and Manly Hospitals. Access in 2028 would therefore be predominantly via Warringah Road (west of Forest Way) or Forest Way (North of Naree Road) instead of from the east.
These refinements, amongst others, provided a more robust assessment of the potential impacts of the hospital due to the extended time period. This traffic model was then further refined since exhibition of that EIS and an updated assessment of the Concept Proposal and Stage 1 Project was included as Appendix D to the Submissions and Preferred Infrastructure Report (GTA, 2015b).

Traffic modelling has been carried out for forecast years detailed in Table 7.1. The year of opening of both the Stage 1 and Stage 2 Project, being 2018, is aligned with the hospital opening (also 2018). A future year scenario of 2028 has also been considered (10 years after opening).

Table 7.1 Traffic modelling scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>(Base Year)</th>
<th>Future Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing (Base) conditions</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>'Do Minimal'</td>
<td></td>
<td>2018 and 2028</td>
</tr>
<tr>
<td>Stage 2 Project (including Stage 1)</td>
<td></td>
<td>2018 and 2028</td>
</tr>
</tbody>
</table>

The discussion of intersection operation performance in this Chapter uses the following definitions to apply to a number of technical terms:

- **Average delay** – The average additional time experienced by vehicles with reference to a base travel time (e.g. the free-flow travel time). This is expressed in seconds per passenger car unit, or pcu.

- **Level of Service (LoS)** – A qualitative index of the operational performance of traffic on a given traffic lane, roadway or intersection, based on service measures such as average vehicle delay, degree of saturation, density and speed during a given flow period. Level of service for intersections ranges from A to F, and are described in Table 7.2.

- **Unreleased demand** – provides an indication of the level of congestion in the modelled traffic network. When unreleased demand is lower it indicates that more vehicles can enter the network and performance is higher.

The commonly used measure of intersection performance, as defined by Roads and Maritime, is vehicle delay. The intersection modelling used determines the average delay that vehicles encounter and provides a measure of the level of service.

The maximum vehicle queue lengths and the average vehicle delay at key intersections have also been analysed to provide an indication of increased traffic impacts of the existing road network associated with the scenarios in Table 7.1. With regards to the average vehicle delay, the LoS for the intersection can be estimated based on the criteria presented in Table 7.2.
Table 7.2 Level of Service criteria for intersections

<table>
<thead>
<tr>
<th>Level of Service (LoS)</th>
<th>Average delay per vehicle (seconds/vehicle)</th>
<th>Traffic signals, Roundabout</th>
<th>Give way and Stop signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Less than 14</td>
<td>Good operation</td>
<td>Good operation</td>
</tr>
<tr>
<td>B</td>
<td>15 to 28</td>
<td>Good with acceptable delays and spare capacity</td>
<td>Acceptable delays and spare capacity</td>
</tr>
<tr>
<td>C</td>
<td>29 to 42</td>
<td>Satisfactory</td>
<td>Satisfactory, but accident study required</td>
</tr>
<tr>
<td>D</td>
<td>43 to 56</td>
<td>Near capacity</td>
<td>Near capacity, accident study required</td>
</tr>
<tr>
<td>E</td>
<td>57 to 70</td>
<td>At capacity, at signals incidents will cause excessive delays</td>
<td>At capacity, requires other control mode</td>
</tr>
<tr>
<td>F</td>
<td>Greater than 70</td>
<td>Extra capacity required</td>
<td>Extreme delay, major treatment required</td>
</tr>
</tbody>
</table>

Source: Guide to Traffic Generating Developments, Roads and Maritime Services, 2002

7.1.2 Construction traffic

The assessment of construction traffic impacts has involved a review of the types of construction activities proposed, staging of work, construction traffic generation and working hours. It also considers the theoretical impact of road and lane closures on traffic capacity, as well as changes to lane widths. Drawing on this quantitative and qualitative assessment, conclusions were then drawn about impacts on through traffic, localised traffic and access issues, impacts on bus operations and the potential for diversionary effects during construction. Mitigation and management measures have been described to minimise impacts where possible.

7.2 Existing environment

7.2.1 Road network

The existing road network includes roads surrounding the site of the hospital (refer to Figure 3.1). The key roads in the network are described below.

Warringah Road

Warringah Road is a major State Road which serves the principal component of the existing road network. It is the main east-west route through the study area, providing access to Brookvale/Dee Why, Chatswood and Sydney CBD via multiple routes onto the Warringah Expressway. Warringah Road carries 70–80,000 total vehicles west of Wakehurst Parkway and 40–50,000 total vehicles east of Wakehurst Parkway per weekday. The posted speed along this section of Warringah Road is 70 km/h.

Warringah Road has a six lane carriageway configuration with wide central median. Between Woodlands Road/Arthur Street and Allambie Road, it has eight sets of signalised intersections.
(at an average spacing of 500 metres) to accommodate pedestrian crossing opportunities and traffic accessing Warringah Road.

Wakehurst Parkway

Wakehurst Parkway is a State Road that runs between Narrabeen in the northeast and Seaforth in the south providing further connections to Sydney CBD via the Spit Bridge and Cremorne. The majority of Wakehurst Parkway is two lanes undivided but widens out to four lanes on the southbound approach to Frenchs Forest Road. Between Frenchs Forest Road and Warringah Road there are four southbound and three northbound lanes and one southbound dedicated bus lane. The road converges back to two lanes undivided on the southern side of Warringah Road.

The posted speed limit along the section of Wakehurst Parkway between Frenchs Forest Road and Aquatic Drive is 70 km/h.

The only access onto Wakehurst Parkway in the study area is through the two signalised intersections with Frenchs Forest Road and Warringah Road. Aquatic Drive and Fitzpatrick Avenue East do not open onto Wakehurst Parkway. In the vicinity of the hospital site, Wakehurst Parkway carries 20–30,000 vehicles daily. It is a significant component of the existing road network as it functions as one of two key north-south routes through the area. The other key north-south route is Forest Way.

Forest Way

Forest Way is a State Road that consists of six lanes and links Frenchs Forest and Belrose to the north, continuing onto Mona Vale Road. To the north of the Forest Way and Warringah Road intersection the area is heavily used by bus customers during peak periods. It has a mid-block signalised pedestrian crossing and bus interchange facility fronting the Forestway Shopping Centre.

The posted speed along most of this section of Forest Way is generally 70 km/h.

While Forest Way has six lanes there are no auxiliary turn lanes which limits its capacity. It carries about 45,000 vehicles daily north of Warringah Road.

Naree Road/Frenchs Forest Road

Naree Road and Frenchs Forest Road are local roads that carry about 20,000 vehicles daily, much higher than typical volumes for the collector functions they were meant to perform. They act as a ‘rat run’ for traffic avoiding congestion on Warringah Road.

The posted speed limit on Naree Road, Frenchs Forest Road West and Frenchs Forest Road East is 50 km/h.

Frenchs Forest Road (East and West) is generally a two lane undivided road, with parking allowed on both sides. On its western half, buses travel in the westbound direction only. The road is not accessible for vehicles with more than a three tonnes load, buses excepted. There are several traffic calming devices to enforce low traffic speeds. A school zone operates outside The Forest High School adjacent to the hospital site.

As described in the Northern Beaches Hospital Road Connectivity and Network Enhancement Project EIS (Stage 1 and Concept Proposal) (Roads and Maritime, 2014) the Stage 1 Project involves widening Naree Road and Frenchs Forest Road to provide two lanes in each direction.
Allambie Road

Allambie Road, south of Warringah Road, is a Regional Road while the section of the road north of its intersection with Warringah Road is a Local Road. Allambie Road consists of two lanes and runs between Manly Vale in the south and Frenchs Forest. It carries about 20,000 vehicles daily and is sign-posted with a speed limit of 60 km/h.

Heavy vehicles and freight

Warringah Road, Wakehurst Parkway and Forest Way are designated as tertiary freight routes (refer to Figure 7.1) in the Metropolitan Road Freight Hierarchy on the State Road Network – Practice Note (TfNSW, 2011), with the proportions of heavy freight vehicles representing between three to five per cent of all vehicles. The freight routes serve end destinations in the industrial and commercial areas of Frenchs Forest, Brookvale, Manly Vale, Dee Why and Warriewood.

Figure 7.1 Sydney freight route hierarchy
(Source: Transport for NSW, Sydney Road Freight Hierarchy Map)

Forest Way, Wakehurst Parkway north of Warringah Road and Warringah Road west of Allambie Road are all designated as Higher Mass Limit roads that can take up to 68 tonne semi-trailers and B-Doubles, while the remaining sections of Wakehurst Parkway (south of Warringah Road) and Warringah Road (east of Allambie Road) could accommodate 4.6 metre high vehicles. Rodborough Road also allows B-doubles up to 25 metres long, but only for vehicles exiting to the Warringah Road designated route only.
Crashes

Of the 270 crashes recorded in the study area during the period January 2010 to June 2013, half were rear-end collisions. No fatal crash was recorded.

The crash data indicates that while crashes occur throughout the study area, they are also relatively concentrated at the intersections. The majority of crash clusters occurred along the Warringah Road corridor. Approximately half of all crashes were rear-end collisions, which may be due to the existing traffic congestion during the peak periods within the study area.

Car parking

On-street car parking is generally not permitted within the Stage 2 Project area including the following locations:

- Warringah Road between Fitzpatrick Avenue East and Allambie Road
- Wakehurst Parkway between Warringah Road and Aquatic Drive
- Allambie Road between Warringah Road and Rodborough Road
- Forest Way between Warringah Road and the Stage 1 Project.

On-street parking is however permitted on a number of the intersecting roads to the south of Warringah Road, including Hilmer Street, Bantry Bay Road and Fitzpatrick Avenue East, and on Aquatic Drive. Based on site observations, parking demands at Bantry Bay Road are high during peak periods, but at Hilmer Street and Fitzpatrick Avenue East demands are typically low and generated by adjacent residences. Occupancy of on-street spaces along Aquatic Drive is moderate to high with use generated by nearby commercial premises.

7.2.2 Performance of the existing road network

The existing road network within the precinct experiences high levels of traffic congestion and volatility, with several of the major intersections operating at or over capacity. During the weekday morning peak period, the network has capacity limitations that make it particularly prone to congestion and subsequent ‘rat running’ of excess traffic demand along local streets. It frequently enters gridlocked conditions despite being tightly managed through access and turning restrictions, and intensive traffic signal coordination.

Approximately eight or nine per cent of the daily traffic volumes on the key roads in the study area occur within peak hours and the existing at-grade intersections currently operate near or at capacity during these times. The morning peak period, when traffic is predominantly moving westwards towards the Sydney CBD, is particularly prone to congestion and frequently enters gridlocked conditions.

The intersection at Warringah Road and Wakehurst Parkway directly adjacent to the hospital site has very high levels of delay and queuing for motorists as vehicles converge from three major arterial road streams into one (Warringah Road east and west, Wakehurst Parkway north and south, and Allambie Road) and are added to again at Forest Way.

The following intersections currently operate at LoS F, with average vehicle delays of greater than 70 seconds during the morning and/or evening peak period:

- Warringah Road and Forest Way
- Warringah Road and Wakehurst Parkway
- Wakehurst Parkway and Allambie Road
• Forest Way and Adams Street.

The daily pattern of activity on Warringah Road is fairly constant in terms of traffic volume. The morning peak periods are much the same throughout the working week (generally 7am to 9am), while the evening peak steadily increases from Monday to Thursday and splits on Fridays (peaking between 4:30pm and 6:30pm). The Saturday peak is of a similar magnitude to the week day peaks, although the peak hour is 12pm to 1pm. Sunday traffic is lower, but with the same peak period as the Saturday.

Travel time surveys carried out in 2013 along Warringah Road indicate that the average speed in the westbound direction during the morning peak period (7am to 9am) is 20 km/h and in the eastbound direction during the evening peak period (4pm to 6pm) is 30 km/h. The travel speed surveys reflected the variability of peak period average travel speeds along sections of Warringah Road.

7.2.3 Transport characteristics

Public transport

Buses are the predominant form of public transport on the Northern Beaches as the nearest railway station located at Chatswood is about nine kilometres to the west. A number of key bus routes servicing the Northern Beaches provide public transport interchange opportunities to rail services at Chatswood. In addition, a number of bus routes provide services linking with Manly Wharf, about 10 kilometres away and from where ferry services to the Sydney CBD are operated.

Previous observations indicate that although bus services are frequent in the study area, they commonly experience considerable delays in traffic through the network. Existing indented bus stops are only designed to cater for one bus at a time. At some bus stop locations (in particular at Forestway Shopping Centre), multiple buses may arrive within a short period and subsequent buses are required to queue in the kerbside lane until the indented bus bay is clear. This results in delays to both the buses and also cars queuing behind in the kerbside lane. As such, longer bus bays and improved bus priority measures would potentially contribute towards increasing their efficiency. Figures 4.15 and 4.16 of the traffic and transport working paper (Appendix C) show the existing bus network in the surrounding area.

A number of bus priority measures are provided in the broader area, with both Warringah Road and Frenchs Forest Road being part of Strategic Bus Corridor 15 (Dee Why to Chatswood). In particular, bus lanes on approach to and departure from major intersections and queue jumps are provided at the following locations in proximity to the Stage 2 Project:

• Bus lanes along the section of Wakehurst Parkway southbound between Frenchs Forest Road and Warringah Road
• Bus queue jumps:
  – Southbound Forest Way turning right to Warringah Road
  – Westbound Warringah Road on the approach to the Wakehurst Parkway intersection
  – Westbound Warringah Road turning right to a bus only link to Frenchs Forest Road East (westbound).
• Bus only sections on Rabbett Street southbound between Holland Crescent and Forest Way.

Sydney Buses and Forest Coaches operate school bus routes through the area in addition to the standard scheduled services. A total of 44 school bus services operate in the morning period and
78 school bus services operate in the afternoon period. These school bus services serve the various schools within the study area (including The Forest High School and Frenchs Forest Public School) and the students who live in the catchment. In addition, a number of school buses stop at the Forestway Shopping Centre (either on Forest Way or at the southbound bus stop on Rabbett Street), this location serving as an interchange point between school bus services and the standard bus services operated by Sydney Buses and Forest Coaches.

Pedestrian infrastructure

The key pedestrian desire lines in the study area are focused on the Skyline Shops towards the eastern end of Frenchs Forest Road, as well as in the vicinity of Forestway Shopping Centre, Bantry Bay shops, The Forest High School and Forest Public School, and the Rabbett Street bus stops at Forest Way. Site observations indicate a significant volume of bus interchange activity at the Rabbett Street bus stop and on the bus stops on either side of Forest Way. These activities include walk access, ‘kiss-and-ride’ and pedestrians crossing Forest Way at the signalised pedestrian crossing. A high number of pedestrians have been observed during morning and evening peak periods using the Forest Way pedestrian crossing to transfer between bus stops on opposite sides of the road.

Overall, pedestrian infrastructure provision is adequate to serve current levels of demand. Footpaths are provided on Warringah Road, with the path on the south side generally following an alignment further away from the road carriageway west of Hilmer Street, connecting with the existing pedestrian bridge across Warringah Road west of the Forest Way intersection, as well as on Forest Way, Frenchs Forest Road and Wakehurst Parkway south of Frenchs Forest Road up to about 100 metres south of Warringah Road.

However, the existing provision of pedestrian facilities can be generally considered of a low standard in terms of encouraging higher levels of walking. There are constraints in pedestrian crossing provision at a number of key signalised intersections, including many that do not have full pedestrian connectivity.

Bicycle infrastructure

There are limited bicycle facilities in the Frenchs Forest area. The Warringah Bike Plan (Warringah Council, 2010) shows a number of proposed on-road and off-road bicycle routes.

It is noted that a number of the proposed on-road bicycle routes in the bike plan are along roads with high volumes of fast-moving traffic (e.g. Wakehurst Parkway, Allambie Road, Warringah Road east of Allambie Road), and pose a challenging cycling environment. There also needs to be better connectivity between the east and west sides of Frenchs Forest Road (the plan only shows no precinct wide east-west link except for Warringah Road and Aquatic Drive).

7.3 Assessment of potential construction impacts

The Stage 2 Project construction activities would generate around 490 heavy vehicle movements on average per day. In addition, there would be around 260 light vehicle movements associated with onsite light vehicle movements and construction personnel travelling to and from the project site during construction. These would be in addition to around 100 heavy vehicles and 130 light vehicles associated with construction of the Stage 1 Project.

The Stage 2 Project construction activities would generate transport and traffic impacts that could generally involve the following:
• Increased travel times due to road work restrictions and thus reduced speed limits around construction sites
• Increased travel times due to increased truck and construction machinery movements, including in the vicinity of the construction compound
• Increased travel times due to potential rerouting/diversion to alternative routes, including for walking and cycling
• Temporary partial or complete closure of roads and altered property access during construction
• Temporary changes to bus access arrangements, including stop relocation, resulting in increased walk distance for certain customers
• Temporary or permanent decrease in kerbside parking
• Temporary impacts to pedestrian access arrangements to The Forest High School from the Warringah Road frontage particularly during school peak activity periods such as start and finish times
• Potential safety issues relating to increased heavy vehicle movements, as well as to higher traffic flows temporarily traversing lower-capacity road sections.

These are discussed further below and are consistent with those identified in the Concept Proposal assessment (Concept Proposal and Stage 1 EIS). As discussed in Section 7.5, a Construction Traffic Management Plan would be prepared to manage construction traffic associated with the project.

Construction routes
Designated access and haulage routes for construction vehicles would be along the arterial road network where practicable (i.e. Warringah Road, Wakehurst Parkway and Forest Way), including movements to transport spoil. Localised construction traffic movements would occur on all roads being upgraded for the Stage 2 Project and on the surrounding road network including Allambie Road and Frenchs Forest Road. Haulage routes are shown in Figure 5.13.

As construction access routes for each would be principally limited to State Roads, the additional construction traffic on these access routes would need to be managed and scheduled to limit impacts. Management measures consistent with those identified in Section 7.5 would be implemented.

Construction traffic impacts
An assessment of potential construction traffic impacts has been carried out using existing traffic volume counts from December 2013, together with indicative construction traffic volumes estimated for both the Stage 1 and Stage 2 Project over the following time periods:

• Morning peak period (6 to 9am)
• Interpeak (9am to 3pm)
• Evening peak period (3 to 6pm)
• Outside standard working hours (6pm to 6am)

Construction sites and compounds would be accessed by different sized heavy vehicle, including over dimensioned and over massed vehicles transporting plant, construction equipment and larger construction components (such as bridge spans for the slot construction). Forest Way,
Warringah Road (west of the project area) and Wakehurst Parkway (north of the project area) are approved by Roads and Maritime for use by vehicles up to and including B-double vehicles. While the exact haulage routes would depend on the origin of materials and destination for material to be transported it is envisaged that the Forest Way/Mona Vale Road route would be most utilised by heavy vehicles accessing the works area to and from the west (haulage routes are presented in Figure 5.10).

Based on this, an analysis of the construction traffic generation estimates with the existing traffic volumes has been carried out, providing a comparative percentage change in traffic volumes at key locations on the road network. Figures 7-7 to 7-10 of the Traffic and Transport Working Working Paper (Appendix C) identify these 10 locations and present the heavy and light vehicle numbers due to the project compared with existing traffic, for each of the four time periods.

The total percentage change on Forest Way, Frenchs Forest Road, Warringah Road and Wakehurst Parkway is typically less than one per cent across all time periods due to the introduction of construction from the Stage 1 and Stage 2 Projects. At Allambie Road, which provides access between the Allambie Road compound site and the Stage 1 and Stage 2 construction sites, the total percentage change is as much as 2.4 per cent.

However, changes to the proportion of heavy vehicles are more substantial due to the low existing truck volumes on these roads (rather than a significant additional level of truck movements).

During the morning peak period, the most pronounced changes are anticipated on Frenchs Forest Road West in the westbound direction (a predicted increase of 17.4 per cent) and Allambie Road northbound (a predicted increase of 12.8 per cent). More modest changes are expected at other locations and in other directions.

In the interpeak period, an increase of more than 60 per cent in heavy vehicles is predicted along Frenchs Forest Road (East and West) and almost 40 per cent along Allambie Road. As noted above, the reason for this substantial proportional change is due to the existing low levels on these roads. Similarly, as above, more modest changes are expected elsewhere.

A similar trend is observed for the evening peak period and outside of standard working hours (6am-6pm), with up to a 45 per cent increase in heavy vehicles along Frenchs Forest Road East and West, and almost 40 per cent along Allambie Road. During these time periods much lower changes are predicted along all other routes, although an increase of around 16 per cent is predicted on Forest Way in the evening peak period.

Given the above it is not anticipated that the additional traffic generated during the construction period would have a noticeable impact on the existing operation of the surrounding road network.

However, given this analysis is based on estimates of construction traffic movements, further analysis would be undertaken to inform the Construction Traffic Management Plan for the Stage 2 Project.

Notwithstanding, at intersections currently operating at LoS E or below (Warringah Road/Wakehurst Parkway, Warringah Road/Forest Way and Warringah Road/Allambie Road) the addition of any additional peak hour construction traffic has the potential to exacerbate existing congestion. As such, traffic activity to construction sites and site compounds would be minimised during peak periods to maintain existing peak period capacities.

The key east–west routes through the area are limited to Warringah Road and Frenchs Forest Road and key north-south routes are limited to Wakehurst Parkway and the Forest Way–Allambie Road route. While the overall contribution of construction traffic to the network is not considered
to be substantial, construction of the Stage 1 Project is anticipated to affect traffic conditions along the Frenchs Forest Road corridor diverting traffic to Warringah Road.

Similarly, the Stage 2 Project along Warringah Road may detour traffic to Frenchs Forest Road. While this would be accommodated following completion of the Stage 1 Project (which would then have increased capacity), when both Frenchs Forest Road and Warringah Road traffic capacities are restricted as a result of concurrent construction staging (i.e. during the Stage 1 and 2 Project construction periods), the cumulative transport impacts of such a scenario may further affect traffic conditions.

The delays from these cumulative impacts would also affect bus travel times in the precinct (both regularly-scheduled buses and school buses). As such, any concurrent closures should be limited to off peak periods when traffic demands are lower (i.e. night time and weekends) and only with the prior approval of the Transport for NSW Transport Management Centre.

These cumulative transport impacts of the Stage 1 Project, the Stage 2 Project and the hospital would inform an integrated scheduling of construction activities for the two stages of the road improvement project. Construction planning (including the development of a detailed Construction Traffic Management Plan) would aim to maintain peak period traffic capacity to manage and mitigate these impacts. Cumulative traffic impacts associated with the hospital are discussed further below.

Other potential factors that may affect traffic performance during construction include a reduction in lane widths and posted travel speeds. Current traffic lane widths along this section of Warringah Road are generally 3.1 metres wide which is less than Roads and Maritime’s optimal lane width of 3.5 metres. This is already likely to result in lower free flow speeds for vehicles. Given Warringah Road represents a key freight route for the Northern Beaches (as discussed in Section 7.2) traffic lane widths on Warringah Road would not be to below three metres wide to minimise impacts on operation, capacity and safety.

Similarly, existing peak hour travel speeds along Warringah Road are well below the posted speed limit. As such, a reduced speed limit for Warringah Road would unlikely have a major impact on the capacity of the corridor, noting that a number of 40km/h school speed zones are already present in the study area during the morning peak period.

An analysis of the relationship between lateral clearances and free flow speeds of roads was also carried out which indicates that a reduction in lateral clearance would have negligible impact on existing speeds during peak periods (again noting the already reduced travel speeds on the network). Speed surveys indicate that current peak hour average speeds on Warringah Road within the Stage 2 Project construction area average between 25 and 38 km/h during the morning peak period and 39 to 41 km/h during the evening peak. Outside of peak periods when the network is not congested reduced lateral clearance would result in a lowering of average travel speeds.
Impacts on parking

On-street car parking is currently prohibited on Warringah Road, Forest Way, Wakehurst Parkway and Allambie Road within the study area. Whilst it is anticipated that some on-street car parking will be permanently lost as part of the Stage 2 Project (refer to Section 7.4), it is not anticipated that any additional on-street car parking will be lost as part of any temporary work associated with the Stage 2 Project.

Road closures

Some traffic lanes on Warringah Road may need to be closed at times between Government Road and Altona Avenue (the approaches to the Stage 2 construction area). These would typically be during off-peak periods (i.e. during the night) when traffic volumes are at their lowest. Roads and Maritime has nominated road closure periods (time of day and day of week) where road closures or lane restrictions could take place. These are outside the critical peak hour and inter peak periods and other critical network periods during the week and weekend, therefore intending to maintain the existing level of network capacity during these important times.

To mitigate impacts to traffic performance the existing number of westbound traffic lanes would be maintained between 5am to 8pm with lane closures possible between 8pm and 5am Sunday to Friday, while eastbound traffic lanes would be maintained between 5am to 10pm Sunday to Friday with lane closures possible between 10pm and 5am. (Eastbound capacity would be maintained for longer than westbound to cater for people returning home from the city in the evening). Proposed lane closure periods on identified roads are shown in Figure 7.2.

An assessment of the existing Warringah Road traffic volumes against the lane capacities (existing and future) for the westbound (inbound) and eastbound (outbound) carriageways, indicates that these traffic volumes are generally contained within the envelope of lane capacity. The only exception to this is a brief period in the morning peak. However, due to the early start to the peak traffic period on this area of the overall network, at least two lanes would be required from 4:00am on weekday mornings. This would ensure adequate capacity is available to accommodate the onset of peak traffic and to limit the potential for early traffic congestion to impact long into the morning peak period.

These road closures would necessitate temporary traffic detours which would increase traffic on surrounding streets during these periods.
Any planned road or lane closure would require the approval of the Transport for NSW Transport Management Centre prior to taking place.

Impacts to the wider regional transport network

While travel times within the construction area would be higher during construction of the Stage 2 Project, it is unlikely that the increase would be sufficient to encourage traffic volumes to use alternative routes.

The only available east-west routes through the project area are Frenchs Forest Road and Warringah Road. Given the nature of the road network in the project area, the alternative routes comprise those in the wider transport network – being Mona Vale Road (about eight kilometres north of Warringah Road) and the Spit Road /Military Road corridor (about six kilometres south of Warringah Road). Due to the extent of roadworks associated with the Stage 1 and Stage 2 Project, there would be limited alternative routes within the project area that would allow “rat running”. Notwithstanding, any potential “rat running” would be addressed in the Construction Traffic Management Plan.

However, if the travel time between the Warringah Road and the alternative competing routes (Mona Vale Road or Spit Road/Military Road) was similar, the increase in travel time during the construction phase may result in some motorists switching to either alternative route instead of Warringah Road. If this was to occur, the Project may result in minor increases in traffic volumes on the Mona Vale Road and/or Spit Road/Military Road corridors during the construction phase of the Stage 2 Project.

Road closures proposed during some evening periods and weekends (see below for theoretical assessment of road closures) may result in substantial increases in travel times through the corridor, which may then result in a shift in traffic volumes to the Mona Vale Road and/or the Spit...
Road/Military Road corridors at these times. It is however noted that there may be similar capacity constraints as a result of the potential concurrent upgrade work on the Mona Vale Road corridor.

Pedestrian and cyclist access
Disruption to pedestrian activity on footpaths is anticipated along Warringah Road, requiring pedestrians to walk longer distances to access facilities or crossing locations at times. Construction activities would also potentially lead to increases in risk levels associated with footpath and crossing diversions.

While there are no existing designated cycle routes in the study area that would be impacted by construction of the Stage 2 Project, local (short-distance) cycling demand in the precinct could be affected in terms of increased general (diverted) and construction traffic volumes, as well as lane and shared path restrictions.

Impacts on public transport operations
Construction of the Stage 2 Project would have the following impacts to public transport operations:

- Potential bus timetable delays due to road work speed restrictions and increased traffic congestion through key affected intersections
- Potential temporary removal of existing bus priority arrangements meaning buses would not have priority at some intersections during some periods of construction (buses would mix with general traffic)
- Alterations to bus stop arrangements, locations and access, including potentially decreased bus passenger waiting areas.

The Stage 2 Project construction will primarily impact on buses that operate along Warringah Road and Wakehurst Parkway including Bus Routes 137, 169, 280 and L60. ‘Knock on’ effects for buses may also be experienced to routes that travel across the work area along Warringah Road.

Impacts to traffic operations of The Forest High School
While construction related impacts to the school would be predominantly related to the Stage 1 Project, the following impacts to The Forest High School are anticipated from the Stage 2 Project:

- Reduced travel speeds and increased travel times for staff, parents and students accessing the school
- Temporary diversions to pedestrian footpaths and crossings
- Potential increased safety risks to school students and staff associated with increased construction traffic movements, including heavy vehicles and equipment.

Construction-related impacts on Frenchs Forest Public School would be similar to those for The Forest High School related generally to reduced travel speeds, inconvenience due to temporary diversions for pedestrians and cyclists, and increased exposure to risk due to construction traffic.

Property access
Only a few properties (residential and businesses including Bantry Bay shops) have direct vehicle access to Warringah Road within the Stage 2 Project area and most of these properties would be acquired. However, in any circumstances where vehicular access is required to be restricted, alternative temporary access arrangements would need to be agreed with affected properties.
The Stage 2 Project also has the potential to impact access to the hospital construction site from Warringah Road. As discussed further below, Roads and Maritime and Health Infrastructure have developed an interface agreement which identifies requirements related to traffic management and access during construction of the projects, including access to respective construction sites.

**Cumulative construction traffic**

There would be numerous concurrent road construction projects potentially having a cumulative impact on the road network. These include construction of the Stage 1 and Stage 2 Projects, the hospital, and the Mona Vale Road upgrades.

Regarding construction of the hospital, the three road projects would use the same arterial road network (i.e. Warringah Road, Wakehurst Parkway and Forest Way) for construction access routes and these additional construction traffic movements would further limit capacity on the network, particularly if carried out during peak commute periods.

Construction of the hospital is predicted to generate around 240 heavy vehicles movements per day. These vehicles will be generated during the morning, evening and interpeak periods, but not outside of standard construction hours. The additional traffic generated by the construction of the hospital equates to less than 0.1 per cent of the existing traffic on Warringah Road in the vicinity of the site for each of these time periods. This would contribute a very minor cumulative impact to the assessment carried out for the combined assessment for the Stage 1 and Stage 2 Projects.

The hospital construction activities would generally be limited to the hospital site and the construction access via Warringah Road (north side) at the Bantry Bay Road intersection. Construction traffic access to the Northern Beaches Hospital site from Warringah Road would be maintained at all times. In the event vehicular access is required to be restricted, alternative temporary access arrangements would need to be agreed with Health Infrastructure. Hospital construction would overlap with the Stage 1 Project construction work on Frenchs Forest Road but have a lesser impact on the Stage 2 Project. The additional construction activities from the hospital and Stage 1 Project construction work would increase travel times on Frenchs Forest Road.

Further, it is anticipated that during construction of the Mona Vale Road upgrade, a portion of Mona Vale Road traffic could divert to Warringah Road. The cumulative impacts of the Mona Vale Road Upgrade and the three other projects would be potential increases peak period traffic volumes on Warringah Road, Wakehurst Parkway and Forest Way, which reinforces the requirement for maintaining peak period traffic capacity within the Stage 2 Project construction area to manage and mitigate these impacts. It is noted, however, that construction of the Mona Vale Road upgrade would potentially only overlap with the other projects by six to twelve months.

Roads and Maritime and Health Infrastructure have developed an interface agreement which identifies requirements related to traffic management and access during construction of the projects. Roads and Maritime would also continue regular meetings with Warringah Council, The Forest High School, Frenchs Forest Public School and emergency services during construction to resolve potential traffic and transport related impacts and to assist coordination of construction activities.
7.4 Assessment of potential operational impacts

The following assessment considers the operational traffic impacts of the Stage 2 Project, assuming the Stage 1 Project is also operational (referred to as the ‘Project Case’).

Network performance

As shown in Table 7.3, the Stage 1 Project would reduce average delays during the morning peak period in 2018 by 27 per cent with Stage 2 reducing delays by a total of 38 per cent compared with the Do Minimal scenario. The predicted average delays during the 2018 morning peak period represent an improvement over the operation of the road network in 2012 (13 per cent reduction).

Due to increased capacity in the network compared with the Do Minimal scenario, the Stage 1 Project would reduce the number of vehicles not able to enter the network during the morning peak period by 32 per cent, while completion of the Stage 2 Project would reduce this measure further to a total reduction of 84 per cent, in both cases indicating a less congested network.

Improvements in unreleased demand indicate that significant improvement is forecast in the operation of the network with the Stage 2 Project than with Stage 1 alone, particularly along the Warringah Road corridor where the slot allows through traffic to bypass a number of signalised intersections.

In the evening peak in 2018 the Stage 1 Project is predicted to reduce average delays by 20 per cent with a 33 per cent reduction predicted by the Stage 2 Project compared with the Do Minimal scenario. Unlike the case in the morning peak period, this represents a slight degradation over the operation of the road network in 2012.

As a result of the increased capacity in the network compared with the Do Minimal scenario, the Stage 1 Project would reduce the number of vehicles not able to enter the network during the evening peak period by 45 per cent, while completion of the Stage 2 Project would reduce this measure further to 71 per cent, in both cases indicating a less congested network.

In this regard, it is noted that almost 5,000 additional peak period vehicle movements are forecast between 2012 and 2018. This indicates that the proposed improvements to the road network result in significant benefits to the traffic congestion in both the morning and evening peak periods.
## Table 7.3 Stage 2 Project network performance results—2018 vs Do Minimal scenario

<table>
<thead>
<tr>
<th>Network Measure (3 hours)</th>
<th>Morning peak period</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Do Minimal</td>
<td>Stage 1</td>
<td>Project Case</td>
<td>Do Minimal</td>
<td>Stage 1</td>
<td>Project Case</td>
<td>Do Minimal</td>
<td>Stage 1</td>
<td>Project Case</td>
</tr>
<tr>
<td>Total traffic demand (vehicles)</td>
<td>43,252</td>
<td>43,283</td>
<td>(+0%)</td>
<td>43,245</td>
<td>(+0%)</td>
<td>52,025</td>
<td>(+0%)</td>
<td>52,155</td>
<td>(+0%)</td>
</tr>
<tr>
<td>Number of vehicles that have left the network (vehicles)</td>
<td>33,837</td>
<td>36,265</td>
<td>(+7%)</td>
<td>39,427</td>
<td>(+17%)</td>
<td>39,357</td>
<td>(+7%)</td>
<td>41,949</td>
<td>(+7%)</td>
</tr>
<tr>
<td>Number of vehicles that remain in the network (vehicles)</td>
<td>3,444</td>
<td>2,950</td>
<td>(-14%)</td>
<td>2,888</td>
<td>(-16%)</td>
<td>3,797</td>
<td>(-20%)</td>
<td>3,047</td>
<td>(-20%)</td>
</tr>
<tr>
<td>Unreleased demand (vehicles)</td>
<td>5,971</td>
<td>4,068</td>
<td>(-32%)</td>
<td>930</td>
<td>(-84%)</td>
<td>8,871</td>
<td>(-19%)</td>
<td>7,159</td>
<td>(-19%)</td>
</tr>
<tr>
<td>Proportion of vehicles unreleased</td>
<td>14%</td>
<td>9%</td>
<td>2%</td>
<td>17%</td>
<td>14%</td>
<td>5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total distance travelled in network (km)</td>
<td>109,444</td>
<td>117,829</td>
<td>(+8%)</td>
<td>125,784</td>
<td>(+15%)</td>
<td>129,531</td>
<td>(+2%)</td>
<td>131,726</td>
<td>(+2%)</td>
</tr>
<tr>
<td>Total time travelled in network (hr)</td>
<td>6,393</td>
<td>5,455</td>
<td>(-15%)</td>
<td>5,286</td>
<td>(-17%)</td>
<td>7,680</td>
<td>(-10%)</td>
<td>6,934</td>
<td>(-10%)</td>
</tr>
<tr>
<td>Average speed (km/h)</td>
<td>17.1</td>
<td>21.6</td>
<td>(+26%)</td>
<td>23.8</td>
<td>(+39%)</td>
<td>16.9</td>
<td>19.0</td>
<td>12.316</td>
<td>(+12%)</td>
</tr>
<tr>
<td>Average delay time per vehicle(sec)</td>
<td>449</td>
<td>327</td>
<td>(-27%)</td>
<td>280</td>
<td>(-38%)</td>
<td>468</td>
<td>385</td>
<td>253</td>
<td>(-46%)</td>
</tr>
<tr>
<td>Total delay time including unreleased time (hr)</td>
<td>8,433</td>
<td>7,714</td>
<td>(-9%)</td>
<td>4,313</td>
<td>(-49%)</td>
<td>14,852</td>
<td>12,316</td>
<td>6,382</td>
<td>(-57%)</td>
</tr>
</tbody>
</table>
Intersection performance

Traffic modelling indicates that the Stage 2 Project would significantly improve the operation of the Warringah Road corridor. This is primarily due to the separation of Warringah Road through traffic from turning surface road traffic at the intersections with Forest Way, Hilmer Street and Wakehurst Parkway. While two of the five intersections along Warringah Road currently operate with a LoS F (2012 Base Case) and all five in the 2018 Do Minimal scenario, the Stage 2 Project would result in only two of the five intersections along the Warringah Road corridor predicted to operate with a LoS F in 2018 and only one in 2028.

An overview of intersection levels of service for the precinct in 2018 and 2028 are presented in Figure 7.3 and Figure 7.4. The data indicates that following the Stage 2 Project there will be an increase in the number of intersections operating with LoS A-D and a decrease in the number of intersections operating with a LoS F compared to the 2012 Base Condition and Do Minimum for 2018 and 2028.

(Note: The number of intersections assessed in the 2012 and future year (2018, 2028) cases is different due to the new intersections that are created to provide access to the hospital and also the new intersection on Wakehurst Parkway at Aquatic Drive).

Figure 7.3 Summary of intersection levels of service in 2018 peak periods
The following intersections are still predicted to operate at LoS F after the completion of the Stage 2 Project in 2018 and 2028 during the morning or evening peak periods (or both, noting that some of these intersections may operate at LoS E or better in the morning and evening peak):

- Warringah Road/Ellis Road/Government Road
- Forest Way/Adams Street
- Frenchs Forest Road/Wakehurst Parkway
- Warringah Road/Forest Way
- Forest Way/Naree Road
- Allambie Road/Aquatic Drive.

All other intersections within the study area are predicted to operate with a LoS E or better for the morning and evening peak periods in 2018 and 2028.

The changes in the level of service of each intersection within the immediate study area for the 2012 base year and the 2018 and 2028 scenarios are detailed in Table 7.5. The Do Minimal and Project Case are considered for 2018 and 2028 (the Project Case referring to Stage 2 Project, including Stage 1 operational). These predictions are consistent with those predicated in the Concept Proposal and Stage 1 Project assessment.
Table 7.4 Summary of morning and evening peak period intersection level of service

<table>
<thead>
<tr>
<th>Intersection</th>
<th>2012 Base Year</th>
<th>2018 Do Minimal</th>
<th>2018 Project Case</th>
<th>2028 Do Minimal</th>
<th>2028 Project Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warringah Road and Forest Way</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>A-D</td>
</tr>
<tr>
<td>Warringah Road and Hilmer Street</td>
<td>A-D</td>
<td>F</td>
<td>A-D</td>
<td>F</td>
<td>A-D</td>
</tr>
<tr>
<td>Warringah Road and Wakehurst Parkway</td>
<td>F</td>
<td>F</td>
<td>E</td>
<td>F</td>
<td>A-D</td>
</tr>
<tr>
<td>Warringah Road and Allambie Road</td>
<td>E</td>
<td>F</td>
<td>E</td>
<td>F</td>
<td>E</td>
</tr>
<tr>
<td>Warringah Road, Ellis Road and Government Road</td>
<td>A-D</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Forest Way and Adams Street</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Forest Way and Naree Road</td>
<td>A-D</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Frenchs Forest Road West and Rabbett Street</td>
<td>E</td>
<td>F</td>
<td>A-D</td>
<td>F</td>
<td>A-D</td>
</tr>
<tr>
<td>Frenchs Forest Road West, Main hospital entrance, and Gladys Avenue</td>
<td>N/A</td>
<td>A-D</td>
<td>A-D</td>
<td>E</td>
<td>A-D</td>
</tr>
<tr>
<td>Frenchs Forest Road and Wakehurst Parkway</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Frenchs Forrest Road East and Romford Road</td>
<td>A-D</td>
<td>F</td>
<td>A-D</td>
<td>F</td>
<td>E</td>
</tr>
<tr>
<td>Frenchs Forest Road East, Patanga Road and Allambie Road</td>
<td>A-D</td>
<td>A-D</td>
<td>A-D</td>
<td>A-D</td>
<td>A-D</td>
</tr>
<tr>
<td>Allambie Road and Aquatic Drive</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
</tbody>
</table>

Note: The number of intersections assessed in the 2012 and future year (2018, 2028) cases is different due to the new intersections that are created to provide access to the hospital and also the new intersection on Wakehurst Parkway at Aquatic Drive.

During the morning peak period the intersections along the Warringah Road corridor are generally predicted to operate with LoS E or better with acceptable average delays forecast at each of the intersections. The only exception is the Warringah Road/Forest Way intersection which is predicted to operate with a LoS F during the 2018 morning peak period, due to queuing from the bus stop at Maxwell Parade (after the merge point between the proposed slot and surface traffic lanes). Although the bus stop at Maxwell Parade is outside the Stage 1 and Stage 2 Project area, its impact on the performance of the road network would be considered further as part of the general network operation.

The Frenchs Forest Road/Wakehurst Parkway and Forest Way/Adams Street intersections are predicted to experience poor intersection operation and average delays in excess of 120 seconds during the morning peak period (LoS F).

During the evening peak period the intersections along the Warringah Road corridor would generally operate with LoS E or better with acceptable average delays forecast at each of the
intersections. The only exception for this period is the Warringah Road/Government Road/Ellis Road intersection which is predicted to operate with a LoS F and with delays in excess of 90 seconds in 2018 and 120 seconds in 2028. Although this intersection is outside the Stage 1 and Stage 2 Project area its performance would be considered further as part of the general network operation.

Travel speeds

Predicted average vehicle travel time along selected routes has been converted to an average vehicle speed for ease of comparison based on traffic modelling. The three routes are shown in Figure 7.5 and are as follows:

- Route 1: Warringah Road (between Government Road and Laurel Chase)
- Route 2: Forest Way (Bowman Avenue) to Warringah Road (Government Road) via Frenchs Forest Road
- Route 3: Forest Way (Bowman Avenue) to Wakehurst Parkway (at overhead pedestrian bridge south of Warringah Road) via Warringah Road.

![Figure 7.5 Travel time routes](image)

The data indicates that the Stage 2 Project would increase average vehicle speeds during the morning and evening peak period. The most marked improvement noted along Route 1 is predicted during the morning peak in the eastbound direction for which travel speeds would increase from 13 to 29 km/h in 2028. In the evening peak travel speeds would increase from 19 to 31 km/h in 2018. It is noted that the speeds presented for this route (along Warringah Road) are for traffic on the surface lanes and not traffic in the slot. Greater average speeds would be anticipated in the slot.

While the traffic modelling predicts a minor deterioration in travel speeds for the 2018 scenario southbound on the Forest Way-Wakehurst Parkway route, substantial travel speed improvements are also anticipated along the same route from eight km/h to 24 kilometres northbound in 2028.
Public transport

The only continuous east-west route through Frenchs Forest area is via Frenchs Forest Road. Some services use sections of Warringah Road, but not the whole length within the project area. The average speeds for the bus route along Frenchs Forest Road for the 7am to 8am and 4pm to 5pm peak hour with and without the project for 2018 and 2028 are provided in Table 7.5.

Table 7.5 Average bus speeds on Frenchs Forest Road (km/h)

<table>
<thead>
<tr>
<th>Period</th>
<th>Direction</th>
<th>Do Minimal</th>
<th>Project Case</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2018 2028</td>
<td>2018 2028</td>
</tr>
<tr>
<td>Morning peak (7am – 8am)</td>
<td>Eastbound</td>
<td>11.6 10.4</td>
<td>14.7 14.7</td>
</tr>
<tr>
<td></td>
<td>Westbound</td>
<td>8.8 9.5</td>
<td>12.3 12.5</td>
</tr>
<tr>
<td>Evening peak (4pm – 5pm)</td>
<td>Eastbound</td>
<td>10.3 10.9</td>
<td>13.7 13.8</td>
</tr>
<tr>
<td></td>
<td>Westbound</td>
<td>14.8 11.6</td>
<td>17.3 14.9</td>
</tr>
</tbody>
</table>

The data indicates that during each of the peak periods bus speeds are anticipated to increase with the Stage 2 Project compared to the Do Minimal scenario, consistent with the predictions in the Concept Proposal assessment.

The two major contributors to bus travel times are dwell times at bus stops (20 seconds per bus stop) and delays at traffic lights. For example, there are five bus stops in close proximity along Frenchs Forest Road which contributes to slower than normal bus speeds.

Other public transport benefits from the Stage 2 Project include extending the existing southbound bus stop on Forest Way opposite the Forestway Shopping Centre to cater for two buses. However, the existing westbound bus stop currently located on Warringah Road immediately south of Fitzpatrick Avenue East would be removed due to its proximity to the merge of the westbound surface road and underpass lanes. Passengers would be serviced instead by the nearby bus stop on Warringah Road at Maxwell Parade, located 220m further south thereby increasing the walking distance for residents some commuters.

It is also noted that Transport for NSW is currently reviewing the bus network that services the wider Northern Beaches area, to inform the design and delivery of the Northern Beaches bus rapid transit project (including kerbside bus rapid transit between Mona Vale and the Sydney CBD). Completion of the Northern Beaches bus rapid transit is a key action in the NSW Government’s Northern Beaches Transport Action Plan, released in June 2014; see the media release at www.transport.nsw.gov.au/media-releases/faster-journey-times-633-million-northern-beaches-transport-action-plan.

As part of its work to deliver the Northern Beaches Transport Action Plan, Transport for NSW is working with Warringah Council and Roads and Maritime to identify and investigate medium and long-term bus servicing scenarios for the Frenchs Forest area, to complement the Stage 1 and Stage 2 Projects. Service improvements will include an improved cross-regional bus service connecting Manly and Dee Why to Chatswood via Frenchs Forest. This east-west service is shown in the Northern Beaches Transport Action Plan, connecting at Frenchs Forest with a direct route from Terrey Hills to the Sydney CBD. Services will be progressively upgraded to operate at a minimum frequency of every 15 minutes in both directions from 6am to 7pm every weekday, and every 10 minutes during commuter peak periods within these times. With the completion of
the Stage 1 and Stage 2 Projects, consideration can be given to the operation of some peak services as limited stop expresses using Warringah Road in place of Frenchs Forest Road, for faster commuter travel.

For the longer term a new east-west bus route parallel to Frenchs Forest Road and Warringah Road will be explored with Warringah Council in the context of Council’s planning for the future local road network in the Frenchs Forest precinct. Also in the long term, the conversion of Warringah Road surface-level kerbside lanes, and/or the reconfiguration of signalised intersections, to support peak period bus priority operations would be able to be investigated, subject to customer demand and an assessment of wider road network impacts from changed traffic management conditions.

Pedestrians and cyclists

A number of new shared-path and footpaths are proposed as part of the Stage 2 Project which would connect into and complement those proposed as part of the Stage 1 Project (consistent with those identified as part of the Concept Proposal and Stage 1 Project).

Shared paths capable of accommodating pedestrian and cyclist movements are proposed on Warringah Road generally between Fitzpatrick Avenue East and Allambie Road, as well as on parts of Wakehurst Parkway, Allambie Road and Forest Way. New and upgraded pedestrian footpaths would be provided on Forest Way, Warringah Road and Aquatic Drive, as shown in Figure 5.1 to Figure 5.4.

The new facilities would improve connectivity between surrounding networks and attractors within the study area including from the residential catchments to the south of Warringah Road to the Forestway Shopping Centre, the Forest High School, Frenchs Forest Public School and the hospital. East-west pedestrian and cyclist movements would also be facilitated along the Warringah Road corridor by the new shared-path network.

The existing pedestrian bridge across Warringah Road west of Forest Way would be replaced with a new shared pedestrian/cycle bridge, while a new shared pedestrian/cycle bridge across Warringah Road would be provided to the west of Hilmer Street. The new pedestrian bridge would provide a grade-separated connection for pedestrians crossing Warringah Road from the residential catchments to the south to The Forest High School and hospital to the north.

The provision of the above cycling facilities is in accordance with the general recommendations of the Sydney’s Cycling Futures.

Road safety

The Stage 2 Project is expected to provide a number of potential road safety benefits. This includes a potential reduction in the frequency of rear end collisions along Warringah Road due to grade separation of through traffic and turning traffic on Warringah Road. The separation of through traffic at the surface intersections may also reduce the frequency of collisions at intersections along Warringah Road. Reduced risk taking by road users by not accepting shorter gaps to make lane changes is also anticipated, which is more typical in a congested network.

While the Stage 2 Project may lead to an increased risk of crashes where the surface and slot traffic merge, this risk has formed a key consideration of the design to ensure that merge and diverge locations meet all relevant safety standards.

The provision of grade separated crossings would also provide improved safety for pedestrians and cyclists crossing Warringah Road. This includes the grade-separated shared pedestrian/cycle crossings of Warringah Road at Forest Way and Hilmer Street, as well as signalised pedestrian crossings across Hilmer Street and hospital access with Warringah Road.
Impacts to The Forest High School and Frenchs Forest Public School

The Forest High School active frontage is to Frenchs Forest Road. There is very little interaction between the school and the Warringah Road frontage. Notwithstanding the following changes are expected from the Stage 2 Project:

- A three metre wide shared path along the Warringah Road frontage of the school to replace the existing footpath
- Provision of a grade separated pedestrian crossing of Warringah Road at Hilmer Street connecting the school to the residential properties to the south of Warringah Road
- Reduction in traffic volumes on Frenchs Forest Road as a result of the increased east-west capacity being created on the Warringah Road corridor.

In the vicinity of Frenchs Forest Public School the Stage 2 Project would provide a replacement pedestrian bridge over Warringah Road west of Forest Way.

Impacts to the regional road network

The Northern Beaches are serviced by three main road connections:

- Warringah Road
- Mona Vale Road (about eight kilometres north of Warringah Road)
- Spit Road (about six kilometres south of Warringah Road).

The morning peak period traffic volumes for each of these roads has been forecast using strategic modelling for the base case and with the Stage 2 Project (including Stage 1). The percentage difference in traffic volume between the base case and Stage 2 Project is shown in Table 7.7.

Table 7.6 Indicative changes in traffic volumes on the regional road network

<table>
<thead>
<tr>
<th>Road</th>
<th>Indicative morning peak traffic volume percentage difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2021</td>
</tr>
<tr>
<td>Warringah Road</td>
<td>+3%</td>
</tr>
<tr>
<td>Mona Vale Road</td>
<td>-1%</td>
</tr>
<tr>
<td>Spit Road</td>
<td>-2%</td>
</tr>
</tbody>
</table>

The Stage 2 Project is predicted to increase morning peak period traffic volumes on Warringah Road by only three per cent by 2021 and four per cent by 2036. These very slight increases in traffic appear to result from similarly slight diversions from Mona Vale Road and Spit Road.

However, as traffic volumes are typically lower during the off-peak periods, there may be spare road capacity outside the peak periods. For example, there may be situations where motorists travel between locations that are situated between these competing routes (such as between Killara and Narrabeen or between Northbridge and Manly). For these motorists, if the travel time between the Warringah Road and the alternative route (Mona Vale Road or Spit Road) was similar, the Stage 2 Project may cause some motorists to use the Warringah Road corridor instead of the alternative route. If this was to occur, the Stage 2 Project may result in a minor reduction in traffic volumes using the alternative competing route (Mona Vale Road or Spit Road).
and an associated increase in traffic volumes on the Warringah Road corridor outside of peak periods.

Car parking

On-street car parking is not permitted along Warringah Road or Wakehurst Parkway within the Stage 2 Project area. However, widening of Warringah Road to the south would remove of some on-street car parking on Bantry Bay Road, Hilmer Street and Fitzpatrick Avenue East.

Most of the 38 spaces that would be removed are along the frontages of properties that would be acquired. The existing on-street spaces on Bantry Bay Road primarily service the Bantry Bay Road strip shops which would be acquired and would therefore no longer generate parking demand. Some car parking would still be provided for the Brick Pit reserve. Similarly, the car parking spaces to be lost on Hilmer Street and Bantry Bay Road currently service the adjacent properties which would also be acquired as part of the Stage 2 Project (those lost would be commensurate with the acquisitions).

Around six spaces would also be lost from Fitzpatrick Avenue East which typically cater for the adjacent residential properties. Observations indicate that the existing on-street car parking demands in this area are typically low. Any displaced car parking demands (albeit minor) could be accommodated further down Fitzpatrick Avenue East or on Panorama Crescent.

Based on the above the anticipated loss of on-street car parking spaces is not anticipated to impact detrimentally on existing on-street parking occupancies.

Local road impacts and changes

The Stage 2 Project would necessitate changes to operation of the following intersections:

- Wakehurst Parkway/Aquatic Drive
- Warringah Road/Maxwell Parade
- Warringah Road/Fitzpatrick Avenue (East)
- Warringah Road/Laneway (between Hilmer Street and Bantry Bay Road).

The Stage 2 Project would provide access from Aquatic Drive westbound to form a new priority controlled intersection with Wakehurst Parkway. The proposed intersection would cater for left in, right in and left out movements (the right turn out of Aquatic Drive into Wakehurst Parkway would be prohibited). The additional connection to Aquatic Drive would have a positive impact by increasing the precinct’s accessibility directly from Wakehurst Parkway rather than having to access the precinct from Warringah Road. This would also alleviate the already congested Warringah Road/Allambie Road intersection where vehicles are currently funnelled to access this precinct. However, while access to the area served by Aquatic Drive would improve, the increase in traffic would result in increased delays to traffic exiting from the connecting roads (i.e., Madison Way, Aquatic Centre access, access driveways to the business parks). This may also exacerbate existing sight distance issues affecting Madison Way. Roads and Maritime will investigate potential solutions to this during detailed design in consultation with Council.

The existing Warringah Road/Maxwell Parade intersection caters for full turning movements. The Stage 2 Project would relocate this intersection approximately 100 metres downstream of the merge point between the slot and surface lanes, necessitating a restriction to the left turn into Maxwell Parade for traffic in central lanes exiting from the slot. Vehicles from the kerbside lane would be permitted to turn left into Maxwell from Warringah Road westbound during all periods (including peak hours). Westbound vehicles on Warringah Road travelling in the central slot lanes
would be required to access Maxwell Parade by turning left from Warringah Road into Currie Road 650m south of Maxwell Parade. The additional travel time and distance required is not considered unreasonable noting the safety benefits of restricting the existing manoeuvre.

The existing Warringah Road/Fitzpatrick Avenue (East) intersection caters for left in and left out movements to the westbound carriageway of Warringah Road. The Stage 2 Project would relocate this intersection to the merge point between the Warringah Road surface lanes and the Forest Way traffic lanes and would prohibit left turn movements from the Warringah Road surface lanes into Fitzpatrick Avenue (East).

Following the restriction of the left turn into Fitzpatrick Avenue (East) westbound vehicles on Warringah Road would be required to access this road via the Hilmer Street intersection with the Warringah Road surface lanes. For vehicles accessing Fitzpatrick Avenue (East) from the east this will represent a minimal increase in travel time and distance. However, vehicles accessing Fitzpatrick Avenue (East) from Forest Way would be required to turn left from Forest Way into Warringah Road and turn right into Hilmer Street from the surface lanes. This additional requirement is not considered unreasonable noting the safety benefits of restricting the existing manoeuvre and is an existing movement that is currently carried out by road users.

Road widening to the south of the existing Warringah Road alignment would impact the laneway extending between Hilmer Street and Bantry Bay Road. Most of the laneway would cease to operated, due to property acquisitions at this location, however a section adjacent to 2 Hilmer Street would remain to maintain access to the property.

**Changed access arrangements**

The Stage 2 Project would necessitate changed property access arrangements at some properties. The properties at 357 Warringah Road and at 2-8 Rodborough Road currently have a single access point to Allambie Road and four to Rodborough Road. The access to Allambie Road is located approximately 20m south of the Warringah Road/Allambie Road signalised intersection. Traffic modelling indicates that vehicles turning right into this access point (giving way to southbound traffic) restricts the capacity of the adjacent signalised intersection. This access point is therefore proposed to be restricted to left in left out movements only to maintain capacity at the adjacent intersection.

The four access points to Rodborough Road also servicing the site allow for fully directional access and as such, the amended vehicle access arrangement would have minimal impact on users of the site.

**7.5 Environmental management measures**

Options development and concept design investigations described in Sections 4 and 5 have sought to minimise traffic and transport impacts as far as possible.

Project-specific management and mitigation measures have been developed with the aim of minimising or mitigating, as far as practical, traffic and transport impacts of Stage 2 Project as described above. The management and mitigation measures draw on best management practice, government standards and guidelines, and specialist knowledge. Potential impacts and site-specific management measures identified to manage those impacts for implementation during the pre-construction, construction and operational phases are summarised in Table 7.7 for the Stage 2 Project.
These mitigation and management measures have been incorporated into the environmental management measures in Section 20.

Table 7.7 Stage 2 Project safeguards and mitigation measures

<table>
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<th>Impact</th>
<th>Environmental management measures</th>
<th>Responsibility</th>
<th>Timing</th>
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</table>
| Construction traffic impacts| • A construction traffic management plan would be developed and implemented as part of the Stage 2 Project. The construction traffic management plan would focus on maintaining general traffic flow and specifying appropriate site accesses and construction traffic routes. It would include:  
  - Traffic Control Plans showing the access arrangements and the detail of required signs and devices  
  - Pedestrian and cyclist management plan  
  - Consultation strategy for access requirements to adjacent properties including The Forest High School and Frenchs Forest  
  - Hours of operation, including prohibitions on queuing outside sites prior to commencement of work  
  - Road safety audit requirements  
  - Any localised improvements/adjustments to existing traffic management arrangements.                                                                                     | Contractor      | Pre-construction |
<p>|                             | • Subject to safety reasons and other environmental impacts (e.g. noise), construction traffic movements would be limited to off-peak periods, with peak period construction staggered to minimise construction traffic during these periods.                        | Contractor      | Pre-construction Construction |
|                             | • Priority would be given to the use of the arterial road network for construction vehicle access routes.                                                                                                                              | Contractor      | Pre-construction Construction |
| Cumulative construction traffic impacts | • Consultation would be carried out with Health Infrastructure to coordinate scheduling of construction activities and deliveries.                                                                                                          | Roads and Maritime | Pre-construction Construction |
|                             | • Consultation would be carried out with Health Infrastructure regarding the need for construction access to the hospital site to focus on the Warringah Road/Bantry Bay Road intersection.                                                    | Roads and Maritime | Pre-construction |
| Property access             | • Access to properties along affected roads would be maintained during construction. The need for any alternative and/or temporary access arrangements would be agreed with affected property managers/owners.                                  | Contractor      | Construction    |</p>
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<th>Impact</th>
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<th>Responsibility</th>
<th>Timing</th>
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<tr>
<td>Operational traffic</td>
<td>• An operational traffic review would be carried out within 12 months of opening of the Stage 2 Project to confirm the operational traffic impacts of the project on Warringah Road, Forest Way and Wakehurst Parkway in close proximity to the hospital. The assessment would be based on actual traffic counts and will assess the level of service at major intersections within the assessed road network. Where necessary, the outcomes of the operational traffic review would be used to identify any additional feasible and reasonable measures to be implemented where it is determined that the level of service has significantly deteriorated as a result of the Stage 2 Project, compared to the levels described in Section 7.</td>
<td>Roads and Maritime</td>
<td>Operation</td>
</tr>
</tbody>
</table>
Impact | Environmental management measures | Responsibility | Timing
--- | --- | --- | ---
| • A protocol would be developed to identify the need for and provision of respite measures for residential receivers in accordance with ICNG. Respite measures may include the restriction to the hours of construction activities resulting in impulsive or tonal noise (such as rock breaking, rock hammering, pile driving), or other appropriate measures agreed between the contractor and residential receiver such as alternative accommodation. | Contractor | Construction
| • Heavy vehicle drivers would be advised of designated vehicle routes, parking locations, acceptable delivery hours and other relevant practices (i.e., minimising the use of engine brakes, and no extended periods of engine idling). | Contractor | Construction

Operational road traffic noise

• Noise mitigation in the form of noise barriers, low noise road surfaces and/or acoustic treatment of existing individual dwellings will be considered, where feasible and reasonable at receivers identified for noise mitigation.

• Consideration of the feasible and reasonable noise management strategies presented in Section 8.5 would be carried out during detailed design, and appropriate noise management measures implemented for the operation phase.

• Within 12 months of the commencement of operation of the project an operational noise review will be carried out. This will include:
  - Monitoring to compare actual noise performance of the project against predicted noise performance
  - An assessment of the performance and effectiveness of applied noise mitigation measures together with a review and if necessary, reassessment of all feasible and reasonable mitigation measures
  - Identification of any additional feasible and reasonable measures that will be implemented with the objective of meeting the criteria in the NSW Road Noise Policy (EPA 2011), when these measures will be implemented and how their effectiveness will be measured and reported.