

Manns Road upgrade – Narara Creek Road intersection, Narara

Volume 1 Review of Environmental
Factors

Roads and Maritime Services | May 2019



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Manns Road upgrade – Narara Creek Road intersection, Narara

Volume 1 Review of Environmental Factors

Roads and Maritime Services | May 2019

Revision 2

Prepared by GHD Pty Ltd and Roads and Maritime Services

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Executive summary

This document is a Review of Environmental Factors (REF) for the upgrade of Manns Road at the intersection of Narara Creek Road and Maliwa Road, Narara (the proposal) as required under Division 5.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The purpose of this REF is to describe the proposal and its potential impact on the environment and to detail the protective measures (safeguards) which would be implemented during construction and operation.

The proposal

Roads and Maritime Services (Roads and Maritime) is planning a future upgrade of the Narara Creek Road Intersection on Manns Road, Narara (the proposal). The proposal is located within the Central Coast Council local government area (LGA) and extends along Manns Road for around 600 metres, Narara Creek Road for 60 metres and Maliwa Road for 80 metres.

Key features of the proposal include:

- Providing an additional through lane on Manns Road northbound and southbound
- Providing an additional traffic lane on Maliwa Road to provide a dedicated left turn lane and combined through lane and right turn lane
- Providing an additional traffic lane on Narara Creek Road to provide a dedicated left turn lane and combined through lane and right turn lane
- Lowering an existing crest to improve the line of sight for vehicles approaching the intersection on Manns Road from the south
- Building a three metre wide shared pathway on the west of Manns Road from 110 metres south of the intersection to 260 metres north of the intersection and on both sides of Narara Creek Road for 60 metres from the intersection
- Providing 1.5 metre wide footpaths along the east of Manns Road north of the intersection and along the westbound verge of Maliwa Road
- Providing a central median on Manns Road from the intersection to about 200 metres north and 150 metres south
- Providing an on-road cycle lane northbound and southbound on Manns Road
- Building a rock-bolted wall extending to about 230 metres south of the intersection on the west side of Manns Road to accommodate the steep slope
- Upgrading and extending drainage infrastructure and stormwater management
- Removing the existing bus bay outside Glenvale School on Manns Road northbound, north of the intersection
- Relocating multiple public utility assets to allow road widening for the intersection upgrade, including undergrounding some existing overhead electricity cables
- Adjusting property boundary fencing, service connections and driveways to accommodate the road upgrade.

Two construction compound areas are proposed for the work. One is located at the intersection of Manns Road and Carrington Street, and the other on the southwest corner of the Dell Road and Manns Road intersection. There is also a proposal for a small temporary stockpile location just to the south of the proposal footprint and on an area of the Manns Road shoulder used as a vehicle pull over.

The proposal is part of an ongoing larger plan to upgrade Manns Road and Pacific Highway between the Central Coast Highway at West Gosford and the M1 Pacific Motorway at Ourimbah.

Need for the proposal

The Manns Road and Pacific Highway corridor is being progressively upgraded to improve road user safety and road capacity to reduce travel time and meet forecast future traffic volumes. In order to gain short-term benefits this intersection is proposed as an early phase of the Stage 5 upgrade between Narara Creek Road and Stockyard Place.

Proposal objectives

The objectives of the proposal are to:

- Provide safer, more efficient travel and improved local access for motorists, pedestrians, cyclists and road freight operators
- Provide increased infrastructure capacity which promotes the long term development of Manns Road on the Central Coast
- Improve facilities for the efficiency of public transport
- Encourage active transport alternatives
- Reduce vehicle operating costs by reducing delays
- Minimise disturbances and delays to traffic during construction.

The overall proposal goal is to achieve the best possible result for each of the objectives, while minimising the impact on the environment and local community.

Options considered

Options considered for the proposal comprised the following:

- **Option 1 – do nothing:** Retain the existing intersection as it is
- **Option 2 – do minimal:** Retain the existing road layout but incorporate more formalised pedestrian and cycle facilities through lane markings and traffic lights
- **Option 3 – upgrade the intersection:** Upgrade the intersection by adding additional turning lanes and upgrade the northbound / southbound approach on Manns Road to two lanes in each direction.

Option 3 was selected as the preferred option as it would enable the proposal objectives to be met, including improved safety for motorists, pedestrians and cyclists, and reducing congestion.

Statutory and planning framework

Clause 94 of *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent. As the proposal is for road infrastructure facilities and is to be carried out by Roads and Maritime, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required. This review of environmental factors (REF) has been prepared as part of the assessment process.

Community and stakeholder consultation

Roads and Maritime has consulted with potentially affected property owners, community members, relevant government agencies and other stakeholders. Roads and Maritime has extensively consulted with Central Coast Council in accordance with the requirements of ISEPP.

Consultation for development of the proposal included meetings with key stakeholders including schools, churches and emergency service providers. Consultation with local Aboriginal stakeholders has also been carried out in accordance with the Roads and Maritime *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (Roads and Maritime, 2011).

Roads and Maritime would continue to consult with the community and stakeholders as planning progresses. Information about the wider program to upgrade the Pacific Highway and Manns Road on the Central Coast (Stages 1 to 5) is also available on the Roads and Maritime website at rms.nsw.gov.au/projects/centralcoast

Environmental impacts

A number of detailed technical investigations were completed to assess the potential impacts of the proposal and to identify measures to manage and mitigate these impacts.

The beneficial effects of the proposal would include:

- Improved road safety at Narara Creek Road intersection
- Improved pedestrian and cyclist safety through the provision of a shared pathway and on-road cycle lane
- Reduced congestion and improved travel times for vehicles travelling through the intersection.

The key potential adverse effects of the proposal would include:

1. Noise and vibration –

The operational noise assessment identified 23 properties which qualify for further consideration of operational noise treatment, comprising 19 residential receivers, two place of worship buildings and two schools. Detailed investigations, including further noise monitoring, would occur for these properties to finalise the extents and types of treatment required in design.

Most construction would be undertaken during standard construction working hours (Monday to Friday 7am to 6pm and Saturday 8am to 1pm). However, it would be necessary to carry out some work outside of these hours, such as for the delivery of oversized equipment and materials, emergency works and for periods when a road occupancy licence cannot be obtained for day time work (for example, for some utility and drainage works).

The following activities are likely to be conducted outside standard construction working hours:

- Removal of median islands at the existing intersection
- Milling and removal of the existing pavement on Manns Road through the intersection
- Placement of final (wearing) asphalt surface
- Tie-in activities on Manns Road to the north and south of the proposal
- Permanent line marking
- Stormwater drainage crossings
- Commissioning of traffic signals
- Utility crossings and 'cut over' of relocated utilities to existing alignments outside the proposal footprint
- Installation and adjustment of barriers and signage during each construction stage and switching of traffic between temporary lanes and routes through the proposal between stages.

Any work carried out outside of standard working hours would be in accordance with the Interim Construction Noise Guideline (DECC, 2009) and the Construction Noise and Vibration Guideline (Roads and Maritime Services, 2016). Prior advice would be given to the community if any work is planned to be carried out outside standard construction hours and the construction contractor would be required to prepare and implement an out of hours work procedure in accordance with Roads and Maritime guidelines.

During construction - without implementation of noise controls - some temporary noise impact on residents is anticipated, with up to 50 residential receivers predicted to be highly noise affected during standard working hours, including some near proposed compound sites. Of these receivers, up to three non-residential receivers (two schools and one church) are also predicted to periodically exceed construction noise management levels, during standard hours.

Predicted construction activities would result in some short-term increases in localised vibration levels, particularly for sensitive residential and sensitive non-residential buildings located close to the proposal site. The expected magnitude of ground vibrations should not be sufficient to cause damage if equipment operates at distances greater than 13 metres from standard residential buildings or structures of similar construction, within this distance additional investigation of alternative equipment and methods and monitoring for impacts would be required.

A Construction Noise and Vibration Management Plan will be prepared to manage noise and vibration caused by the proposal through implementing reasonable and feasible mitigation measures that would include selecting less noisy construction equipment, scheduling work to minimize out of hours work activities, providing respite periods and targeted community consultation, implementing buffer zones where practical and monitoring impacts.

2. Biodiversity –

2.43 hectares of exotic and low condition native vegetation would potentially be impacted for the construction of the proposal. This includes:

- 0.88 hectares of plant community type (PCT) 1579 Smooth-barked Apple, Turpentine-Blackbutt open forest on ranges of the Central Coast. This vegetation is not listed as threatened or vulnerable under state or federal legislation.
- 1.55 hectares of exotic grassland with scattered native and planted remnant trees. This vegetation is not listed as threatened or vulnerable under state or federal legislation.
- 0.11 hectares of PCT 1723 *Melaleuca biconvexa* - Swamp Mahogany - Cabbage Palm swamp forest of the Central Coast, which is a threatened ecological community under state and federal legislation. This is located along the property boundaries of compound site 2 near Carrington Street, however it is proposed to exclude and fence off this area from any lease negotiated on this land for construction purposes and no impact is predicted on this vegetation.

Construction of the proposal would also have the potential to impact on several species of threatened microbats through removal of two hollow bearing trees and the loss of about 0.88 hectares of potential foraging habitat in the southern part of the proposal footprint. This includes:

- Eastern Freetail Bat (*Mormopterus norfolkensis*)
- Eastern Bentwing Bat (*Miniopterus schreibersii*)
- Little Bentwing Bat (*Miniopterus australis*).

However, assessments of significance concluded that the proposal is unlikely to cause a significant impact as only a small area of potential roosting and foraging habitat is present in the proposal footprint, and there are extensive areas of the same vegetation directly adjacent to this habitat with similar habitat resources.

There would not be a significant impact to any other threatened species recorded in the proposal footprint or any threatened species with potential to occur determined through habitat assessment. The proposal would not cause significant impacts to threatened species, and a Species Impact Statement or Biodiversity Development Assessment Report is not required.

A range of safeguards (Section 6.2.4) to minimise the impacts on native vegetation would be included in the Construction Environmental Management Plan, such as clearly marking the boundaries of clearing allowed for the proposal footprint, undertaking pre-clearing checks for significant habitat and plant and animal species, as well as identifying threatened ecological communities and threatened species inside the proposal footprint for exclusion from disturbance by proposal activities where possible. Safeguards would be carried out in accordance with the Roads and Maritime Service Biodiversity Guidelines (Roads and Traffic Authority, 2011).

3. Socio-economic –

During construction there would be a temporary inconvenience to the local community and businesses as a result of traffic congestion, altered access and reduced amenity due to noise and dust impacts.

Road widening would require the partial strip acquisition of land around two residential properties, an area of open space within the Glenvale School and an area of land beside the school oval at St Philip's Christian College, which may result in the permanent loss of some informal private open space. This is not expected to impact any buildings on school property or reduce the functional areas of the school oval within St Philip's Christian College (refer to Section 6.5). Minor driveway adjustments would be required for a majority of the properties along the east of Manns Road adjacent to the proposal. All existing accesses would be reinstated to suit the new road formation. As such, any changes to access would be a negligible impact.

Informal parking on the verges of Manns Road within the proposal footprint would be permanently removed during operation. Existing parking on verges is informal, uncontrolled and in places potentially unsafe for pedestrians, road users and local residents. On street parking along local roads will remain, and would be enhanced by improved footpath connections, providing an alternative for visitors. Given the overall community benefit through the removal of informal parking along verges to accommodate new connected pedestrian facilities, this would be a negligible impact.

Ongoing engagement with property owners and the community through a number of management plans identified in this REF, and implemented through a *Construction Environmental Management Plan*, will reduce impacts on the local community and businesses. In the long-term, the community would benefit from reduced congestion, improved cycle and pedestrian facilities and a safer road.

4. Traffic and access –

The construction of the central median would restrict access to and from residential properties along part of Manns Road to left in, left out only. This may require residents to take alternate routes. For residents coming from the south on Manns Road to access the properties on the eastern side, they may utilise side streets such as Glenmaggie Close to find safe routes to turn back. This would add up to 700 metres or one minute travel to the southernmost residential property.

One bus bay would be removed as a result of the proposal, located on the west of Manns Road just north of the intersection, however consultation with the nearby school indicates this is not a key mode of transport for students and an alternative bus stop is located about two minutes' walk away.

During construction, which is predicted to take up to 18 months, short-term restricted access and congestion is likely within the proposal footprint. Areas affected by construction would be staged to minimise the impact to receivers as much as possible. A requirement for maintaining temporary and alternative access for vehicles and pedestrians to commercial premises would be implemented through a *Traffic Management Plan* at all times during construction.

5. Soils and Geology –

The southern portion of the proposal footprint would be excavated below current road levels to decrease the grade and increase the line of sight on Manns Road just south of Narara Creek Road. The proposal would also require excavating into the steep slope south west of the proposal footprint to accommodate the additional traffic lanes at the intersection and approaches. To the north in the proposal footprint there will be disturbance to and addition of extra material to broad areas of sloping roadside. These activities would increase the risk of soil erosion during construction as soil would be exposed and open to disturbance.

With the implementation of sediment and erosion controls as described in Section 6.6.4, no significant impacts on soil are expected.

A range of safeguards have been included in this REF to manage and reduce these impacts including the requirement for further noise assessment during detailed design, preparation of a construction environmental management plan with a number of specific sub-plans and ongoing detailed engagement with local residents and schools.

Justification and conclusion

The Narara Creek Road intersection is in a strategic location as it forms part of the link between the Central Coast Highway and the M1 Pacific Motorway, but is also between Showground Road and Manns Road. It is also the only traffic light controlled intersection in the area serving subdivisions to the west and local schools which also allows for a controlled turn onto Manns Road during busy periods.

The proposal is considered to be justified as it would reduce existing and forecast traffic delays and congestion along Manns Road near the intersection. Without construction of the proposal, traffic congestion would worsen, with modelling predicting a reduction in vehicle speeds to about 25 kilometres per hour for northbound traffic and seven kilometres per hour for southbound traffic towards the intersection.

Safety would be improved by increasing the line of sight on Manns Road for the northbound approach to the intersection by lowering the existing crest. The proposal would provide additional pedestrian footpaths, shared pathway and cycle lanes to promote a well connected community with active transport opportunities.

The proposal is considered to be consistent with Government strategic planning at Commonwealth, State and regional levels as it would lead to improved efficiency and safety of the road network.

While there would be some environmental impacts as a consequence of the proposal, they have been avoided or minimised wherever possible through design and site-specific safeguards. The beneficial effects are considered to outweigh the adverse impacts and risks associated with the proposal.

The proposal is subject to assessment under Division 5.1 of the EP&A Act. This REF has examined and considered all matters affecting or likely to affect the environment by reason of the proposed activity.

Display of the review of environmental factors

This review of environmental factors is on display for comment between 20 May 2019 and 14 June 2019. You can access the documents in the following ways:

Internet:

The documents are available to view or download on the Roads and Maritime Services website at rms.nsw.gov.au/mannsroad

Display:

The documents can be viewed at the following locations:

- Central Coast Council's Gosford Office on Mann Street

How can I make a submission?

To make a submission on the proposal, please send your written comments to:

Roads and Maritime Services
Central Coast Office
Locked Bag 2030
Newcastle NSW 2300

Email: central.coast.office@rms.nsw.gov.au

Online: visit rms.nsw.gov.au/mannsroad

Submissions must be received by 5pm 14 June 2019.

Privacy Information

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

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

The supply of this information is voluntary. Each respondent has free access at all times to the information provided by that respondent but not to any identifying information provided by other respondents if a respondent has indicated that the representation should be kept confidential. Any respondent may make a correction to the information that they have provided by writing to the same address the submission was sent.

The information will be held by Roads and Maritime Services, Level 2, 1 Bryant Drive, Tuggerah NSW 2259.

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Volume 2

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1. Introduction

1.1 Proposal identification

Roads and Maritime Services (Roads and Maritime) is planning a future upgrade of the Narara Creek Road Intersection on Manns Road, Narara (the proposal). The proposal is located within the Central Coast Council local government area (LGA) and extends along Manns Road for around 600 metres, Narara Creek Road for 60 metres and Maliwa Road for 80 metres.

The surrounding land use comprises a low density residential area, with scattered areas of environmental conservation, schools and public recreation.

The proposal comprises an early phase of work within Stage 5 (Stockyard Place West Gosford to Narara Creek Road Narara) of the larger ongoing program to upgrade the Pacific Highway and Manns Road corridor between the Central Coast Highway at West Gosford and the M1 Pacific Motorway at Ourimbah (Figure 1-1).

The proposal is about 600 metres in length, comprising 300 metres south and 300 metres north of the Narara Creek Road/Maliwa Road Intersection. Key features of the proposal would include:

- Manns Road – additional lane at the intersection on Manns Road northbound and southbound to provide left turn lane, right turn lane and two through lanes
- Maliwa Road and Narara Creek Road – additional lane to provide left turn lane and combined through lane and right turn lane at each
- Providing a central median on Manns Road from the intersection to about 200 metres north and 150 metres south
- Large rock-bolted wall extending to about 230 metres south of the intersection on the west side of Manns Road to accommodate the steep slope topography
- Providing on-road cycle lane northbound and southbound on Manns Road
- Providing a shared path (for use by both pedestrians and cyclists) on the western side of Manns Road
- Providing a shared pedestrian and cycle crossing on the Maliwa Road side and pedestrian crossings on the remaining three sides
- Upgrading and extending drainage infrastructure and stormwater management
- Relocating multiple public utility assets (including undergrounding some existing overhead electricity cables) to allow road widening for the intersection upgrade
- Adjusting property boundary fencing, service connections and driveways to accommodate the road upgrade.

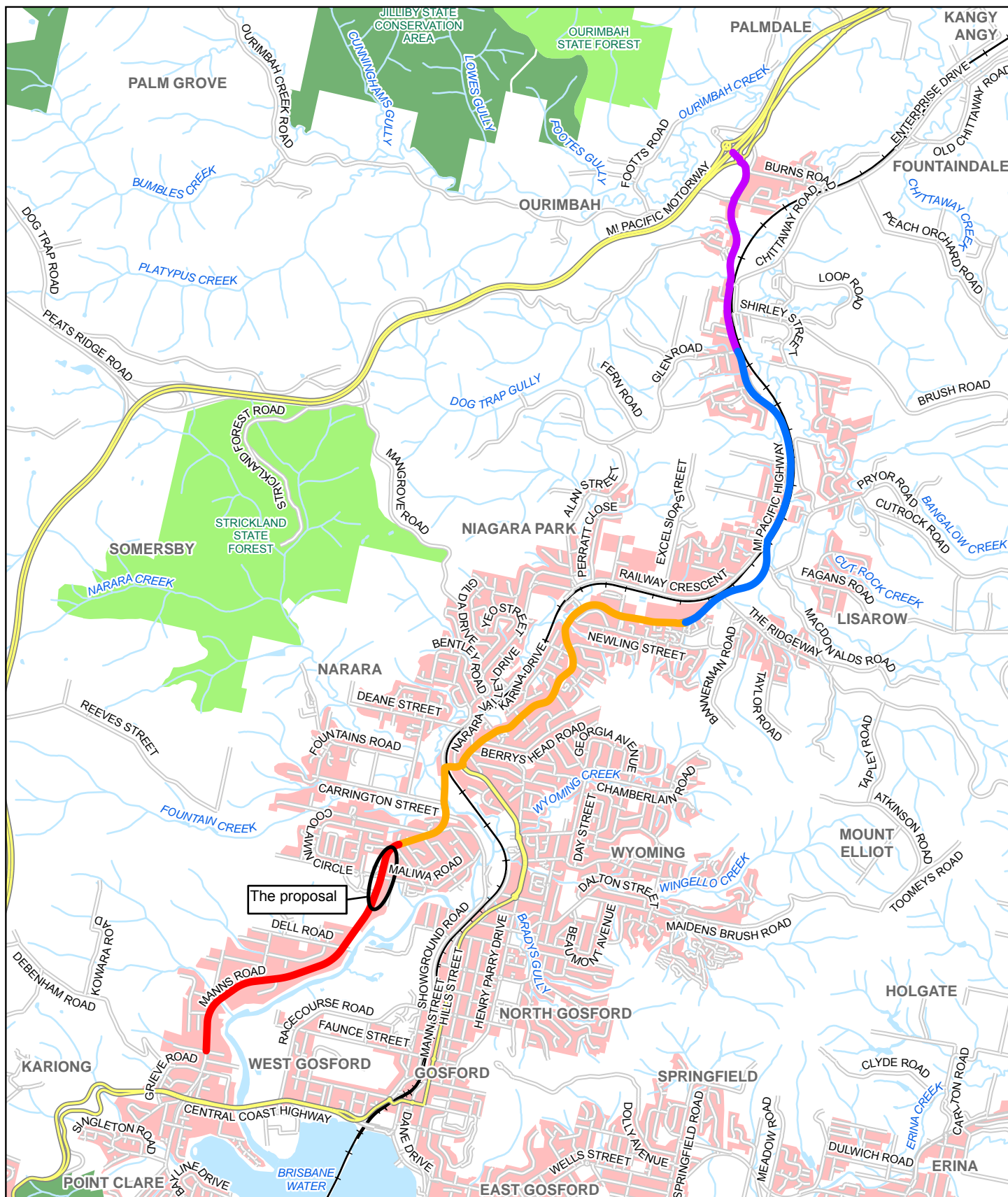
Two construction compound areas and one small temporary stockpile location are proposed for the work. One is located at the intersection of Manns Road and Carrington Street, and the other on the southwest corner of the Dell Road and Manns Road intersection.

The location of the proposal is shown in Figure 1-1 and an overview of the proposal is provided in Figure 1-2. Chapter 3 describes the proposal in more detail.

In this report, the following terms and definitions are used:

- Stage 5: the fifth stage of upgrade work for the Pacific Highway and Manns Road between the Central Coast Highway at West Gosford and the M1 Pacific Motorway at Ourimbah. Stage 5 comprises the Manns Road upgrade from Stockyard Place, West Gosford to Narara Creek Road, Narara (Figure 1-1)

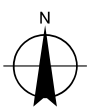
- The proposal: Manns Road upgrade – Narara Creek Road intersection, Narara as outlined in Section 1.1 and Figure 1-2 of this REF.
- Proposal footprint: areas which would be directly impacted by construction of the proposal including the operational design, additional area for possible stockpiles and compounds, temporary public and construction access, private property adjustments such as driveways and fences, and public utility relocations.



LEGEND

The proposal	Stage 5 (this Project)	Railway	Waterbody
Stages 1 & 2	Major road	Watercourse	State Forest
Stage 3	Minor road	Built up area	Reserve
Stage 4			

Paper Size A4
0 350 700 1,050 1,400
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Roads and Maritime Services
Manns Road Upgrade
Review of Environmental Factors
Narara Creek Road Intersection Upgrade

Job Number 22-19033
Revision 1
Date 03/10/2018

Location of the proposal

Figure 1-1

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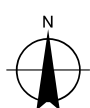
Data source: LPI: DTDB / DCDB, 2017. Created by:tmorton



LEGEND

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|----------------|-----------------|-------------------|
| Concept design | Watercourse | Median |
| Retaining wall | Design Features | Pavement |
| | Earthworks | Proposal boundary |

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Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Roads and Maritime Services
Manns Road Upgrade
Review of Environmental Factors
Narara Creek Road Intersection Upgrade

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The proposal

Figure 1-2

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1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by GHD on behalf of Roads and Maritime. For the purpose of these works, Roads and Maritime Services is the proponent and the determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

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

The description of the proposed work and associated environmental impacts have been carried out in the context of clause 228 of the Environmental Planning and Assessment Regulation 2000, the factors in *Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979* (Is an EIS required? guidelines) (DUAP, 1995/1996), *Roads and Related Facilities EIS Guideline* (DUAP 1996), the *Biodiversity Conservation Act 2016* (BC Act), the *Fisheries Management Act 1994* (FM Act), and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In doing so, the REF helps to fulfil the requirements of Section 5.5 of the EP&A Act including that Roads and Maritime examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

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

2. Need and options considered

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

2.1 Strategic need for the proposal

Manns Road and the Pacific Highway between the Central Coast Highway at West Gosford and the M1 Pacific Motorway at Ourimbah is a strategic route for access to and from the M1 Pacific Motorway in the north and the light industrial areas accessed along this route. The Pacific Highway and Manns Road are being progressively upgraded to date in a north to south direction to improve road user safety and road capacity to reduce travel time and meet forecast future traffic volumes. The M1 Pacific Motorway to Ourimbah Street being Stages 1 to 3A have been constructed, Stage 3B between Ourimbah Street and Parsons Road is being prepared for construction starting in 2019 and Stage 4 is in early design planning, with the stage between Stockyard Place and Narara Creek Road (Stage 5), of which this proposal is part, now currently in planning.

The proposal at the Narara Creek Road intersection is intended to be constructed before remaining Stage 5 work to contribute to an early improvement in the traffic flow and safety on Manns Road in a timely and economic manner, and allows the time to fully plan, program, fund and complete other future work. The Narara Creek Road intersection is in a strategic location as it forms part of the link between the Central Coast Highway and the M1 Pacific Motorway, but also between Showground Road and Manns Road. It is also the only traffic light controlled intersection in the area serving subdivisions to the west and northwest which allows a safe turn onto Manns Road.

The intersection is needed for the following key reasons:

- **Safety** – There is currently a crest in the road on the northbound approach to the intersection, resulting in a reduced line of sight to the intersection and an associated reduction in safety for motorists, pedestrians and cyclists. In the five years between 2013 and 2017, there were six reported crashes at Narara Creek Road intersection and five on Manns Road up to 400 metres north and 400 metres south of the intersection. The majority of crashes involved a rear-end collision. The next most common involved turning in front of an oncoming vehicle and then collision at the intersection between approaching vehicles. Improvements to turning facilities at the intersection and improved visibility for approaching vehicles by a lowering of the crest would help in improving safety for turning vehicles at the intersection.
- **Congestion and delays** – There is currently about 11,000 to 18,000 vehicles per day using Manns Road within the proposal footprint, with congestion and delays being experienced during peak periods, particularly at the northbound approach to Narara Creek Road intersection. The existing sign posted speed limit on Manns Road within the proposal footprint is 60 kilometres per hour, although the current average travel speed in peak periods is about 43 kilometres per hour, which would continue to decline without the proposal. By 2036, without implementing the proposal, the speed on the northbound approach to the intersection is predicted to reduce to as low as seven kilometres per hour.
- **Public and active transport** – The proposal footprint comprises a key bus route along Maliwa and Manns Roads for local residents and community facility visitors, including the schools and church. However, there is currently very limited provision for pedestrians and cyclists, with little to no footpath connection from the bus stops. The proposal would provide additional pedestrian footpaths, shared pathway and cycle lanes to promote a well connected community with active transport opportunities.

The proposal also addresses a number of plans and strategies for the region and the state, as described in the following sections.

2.1.1 NSW Future Transport Strategy 2056

The NSW Future Transport Strategy 2056 is an update of NSW's Long Term Transport Master Plan. The strategy sets the 40 year vision, directions and outcomes framework for customer mobility in NSW, which will guide transport investment over the longer term. It will be delivered through a series of supporting plans. The strategy includes regional NSW committed initiatives for the next 10 years (up to 2026), which specifies upgrade of the Pacific Highway and Manns Road from Central Coast Highway to Narara Creek Road and from Narara Creek Road to Parsons Road. The proposal forms an integral part of this as it is part of both of these committed initiatives.

2.1.2 NSW Road Safety Strategy 2012-2021

The NSW Road Safety Strategy 2012-2021 (NSW 2021) establishes the direction of road safety in NSW for the next 10 years. The strategy supports the short-term action of the National Road Safety Strategy 2011-2020. NSW 2021 aims to improve road safety by identifying and upgrading black spots, promoting safety features in cars, enforcing speed limits and other road rules, and education to encourage road users to take less risks on NSW roads.

The key directions identified within the national and state strategies are considered consistent with the objectives of the proposal (refer to Section 2.2.5) and the anticipated outcomes of the proposal, in particular improvements at the crest at the approach to the intersection. The proposal would also provide additional capacity at the intersection, reducing traffic queues and potential crashes.

2.1.3 Central Coast Regional Plan 2036

The Central Coast Regional Plan 2036 is the NSW Government's 20 year plan which will guide land use planning priorities and decisions. The strategy identifies an additional 41,500 dwellings and 24,674 new jobs are to be generated on the Central Coast to provide for the additional 75,500 people predicted to be living on the Central Coast by 2036.

To achieve this vision, the NSW Government has set four goals for the region:

- A prosperous Central Coast with more jobs close to home
- Protect the natural environment and manage the use of agricultural and resource lands
- Well-connected communities and attractive lifestyles
- A variety of housing choice to suit needs and lifestyles.

The proposal is not specifically identified in the strategy, however, it would provide improved access between the M1 Pacific Motorway and the Central Coast Highway and increase public transport, pedestrian and cycle connections along the Southern Growth Corridor, which contributes to the goals of the plan.

2.1.4 Regional NSW Services Infrastructure Plan 2056

The Regional NSW Services Infrastructure Plan 2056 is an overarching strategy that provides a long term strategic vision at the state wide level for regional NSW. The strategy is a 40 year vision for how transport can support growth and the economy of NSW.

To achieve this vision, the NSW Government has set six outcomes to guide investment, policy and reform and service provision:

- Customer focused
- Successful places
- A strong economy
- Safety and performance
- Accessible services
- Sustainable.

The strategy identifies four goals for the Central Coast region:

- A prosperous Central Coast with more jobs close to home
- Protect the natural environment and manage the use of agricultural and resource lands
- Well-connected communities and attractive lifestyles
- A variety of housing choice to suit needs and lifestyles.

The Pacific Highway and Manns Road upgrade from Narara Creek Road to Parsons Road is listed as a committed initiative in this strategy. The proposal achieves the goals of this strategy by improving access between the M1 Pacific Highway and Manns Road and increasing pedestrian and cycle connections, contributing to the four goals for the Central Coast region.

2.1.5 Central Coast Regional Transport Plan 2013

The Central Coast Regional Transport Plan 2013 (NSW Government 2013a) outlines specific actions to address the unique challenges of the area and looks at population changes in the Central Coast region, including the expected 21 per cent increase in population projected over the next 20 years.

The plan commits to investment in the urban road network to:

- Improve road safety
- Make walking and cycling easier and safer
- Address capacity constraints which impact on travel time reliability and public transport operations.

While the proposal is not specifically mentioned in the plan, it is consistent with the key commitments as it would provide improved safety by reducing the crest, provide walking and cycling facilities and provide increased capacity to reduce travel time for vehicles and public transport.

2.2 Existing infrastructure

This section describes the existing roads and infrastructure in the area, which has helped define the need for the proposal and options available.

2.2.1 Road configuration

Manns Road is a state road (MR349) providing a critical north-south link together with the Pacific Highway between M1 Pacific Motorway at Ourimbah and the Central Coast Highway at West Gosford. It has a posted speed limit of 60 kilometres per hour. Narara Creek Road and Maliwa Road are 50 kilometres per hour zones, although Narara Creek Road also has a 40 kilometres per hour school zone west of the intersection. The existing intersection of Narara Creek Road/Maliwa Road and Manns Road is controlled with traffic lights which provide for all turning movements for both Manns Road and the two intersecting local roads. Turning bays are providing for all right and left turn movements from Manns Road into the local roads. Narara Creek Road has simple line marking at the intersection with a marked left turn lane heading north. There are no line markings at the intersection on Maliwa Road to identify turning lanes, but a left turn on red light is permitted out of Maliwa Road heading south.

Manns Road currently provides a single lane (varying from 3.2 to 3.7 metres wide) in each direction between Dell Road and Wananda Road (about 300 metres north of the intersection with Narara Creek Road). Approaches to the north and south of the intersection currently have no central raised median and multiple access points for resident driveways. Formal access to Glenvale and St Philip's Christian College are off the eastbound and westbound lanes of Narara Creek Road, respectively. The Glenvale School access is within the proposal footprint (about 80 metres west of the intersection), but the St Philip's Christian College access is outside the footprint. On Manns Road northbound, there is an access road to the C3 Church and an unnamed road to a residential area about 200 and 280 metres north of the intersection. Remaining areas of roadside currently are grassed verges with open surface drainage. A short length of concrete v drain exists on Manns Road to the south to drain from an open vegetated cutting to the west.

About 150 metres to the south of the intersection, the topography becomes relatively steep, with a hill on the west of Manns Road and an associated crest in the road, which causes restricted line of sight distance for motorists travelling on Manns Road northbound towards the intersection. Several residential properties next to the southbound lane of Manns Road to the south of the intersection (east side) have steep driveway access.

The intersection of Wananda Road at the northern extremity of the proposal is not controlled by traffic lights and is restricted to a left in left out arrangement with no right turns from or onto Manns Road. This local intersection is within the proposal footprint but not directly affected by the proposed upgrade design.

2.2.2 Bus facilities

There are three bus stops within the proposal footprint (Figure 2-1):

- One stop on Manns Road western side about 50 metres north of the intersection next to Glenvale School, consisting of an asphalt bus bay with bus shelter
- Two stops in Maliwa Road about 50 metres from the intersection, one on the eastbound side with a shelter and one westbound with no shelter and signpost only.

There are also three bus stops just outside of the proposal footprint, including one on either side of Manns Road just north of the proposal and one on Narara Creek Road westbound servicing St Philip's Christian College, which is used by local school bus services only.

2.2.3 Pedestrian and cycle facilities

Currently pedestrian and cycle facilities in the proposal footprint are limited and focussed on the two schools and bus facilities in the west of the proposal. The intersection at Narara has signals to control pedestrian crossing on all sides of the intersection except for Manns Road on the southern approach.

Manns Road has narrow road shoulders and one adjacent dedicated cycle facility consisting of a painted cycle lane along the northbound road shoulder from 70 metres north of the current intersection. There are no dedicated cycle facilities on the intersecting local roads.

There is concrete footpath on the western side of Manns Road, north of the existing intersection and on both sides of Narara Creek Road, connecting a bus bay and crossings with the entry to two schools and another 200 metre section of concrete path north along the edge of the Manns Road verge along the boundary of the Glenvale school (Figure 2-1); otherwise there are no formal pedestrian paths in the proposal footprint.

2.2.4 Parking facilities

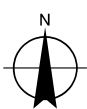
There is no formal parking facilities currently near the intersection. However, there is uncontrolled parking along the verge of Maliwa Road (mostly on the eastbound verge) and Narara Creek Road and on a grassed area in the road corridor to the west of Manns Road. Off-street parking exists within private residences and within the C3 Church, Glenvale School and St Philip's Christian College, including a small parking and drop off area with a loop at the front of the school.



LEGEND

- | | |
|--------------------|------------------|
| Proposal footprint | On-road cycleway |
| Bus Stop | Contour |
| Footpath | Watercourse |

Paper Size A4
0 25 50 75 100
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Roads and Maritime Services
Manns Road Upgrade
Review of Environmental Factors
Narara Creek Road Intersection Upgrade

Job Number 22-19033
Revision 1
Date 03/10/2018

Existing infrastructure

Figure 2-1

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2.2.5 Utilities

There are major public utility installations next to existing traffic lanes. Existing known utilities and corresponding authorities which are within the extents of the proposal are:

- Overhead and underground electricity – Ausgrid (11, 33, 66 and 132 kilovolts)
- Water reticulation – Central Coast Council (100 millimetre diameter pipe)
- Sewer reticulation – Central Coast Council (225 and 150 diameter pipes)
- Telecommunications – Telstra /NBN, NextGEN, Optus, TPG Communications (P100 conduit)
- Gas reticulation – Jemena (high pressure secondary gas main 1050 kilopascals - 150 mm diameter, medium pressure 250 kilopascals - 50 millimetre main and 110 millimetre main).

2.2.6 Drainage

Stormwater drainage consists of a mixture of formal kerb and underground pipes and more informal overland flows and grass verges and swales. Manns Road grades in a north-south direction near the Narara Creek Road intersection with a crest located just south of the intersection. The southern portion of Manns Road within the proposal footprint therefore drains to an existing drainage pipe crossing under Manns Road at the southern limit of work while the northern portion, including Narara Creek Road and Maliwa Road, drains to a drainage reserve via existing culverts opposite Wananda Road intersection.

Concrete kerb with some stormwater drainage exists immediately around the intersection and for short variable lengths north and south on Manns Road from the intersection for a short length down each side of the intersecting local roads. There is limited existing drainage south of the intersection with a few pits provided along the eastern kerb alignment, while on the western side of Manns Road there is only a concrete lined drain next to the road shoulder and a catch drain further up the cut slope.

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

The objectives of the proposal are to:

- Provide safer, more efficient travel and improved local access for motorists, pedestrians, cyclists and road freight operators
- Provide increased infrastructure capacity which promotes the long term development of Manns Road on the Central Coast
- Improve facilities for the efficiency of public transport
- Encourage active transport alternatives
- Reduce vehicle operating costs by reducing delays
- Minimise disturbances and delays to traffic during construction.

The overall proposal goal is to achieve the best possible result for each of the objectives, while minimising the impact on the environment and local community.

2.3.2 Development criteria

The development criteria for the proposal includes:

- Provide a road with a level of service D or better for 2039 forecast traffic volumes
- Provide appropriate facilities for walking and cycling
- Cater for public transport during construction
- Maintain and provide safe access to residential properties and community facilities
- Upgrade stormwater drainage and ensure flood immunity is no worse than current
- Maintain existing utilities during construction.

2.3.3 Urban design objectives

Urban design objectives for the proposal are to:

- Ensure the road, intersections and approaches are a sensitive fit within the Manns Road corridor and its setting
- Minimise adverse impacts on surrounding development by considering existing built form and land uses
- Ensure the pedestrian and cycle connections are enhanced to provide better connectivity and improve safety
- Ensure the new roadworks are designed to be integrated with the existing road network and reflect the important role of the road corridor in wayfinding in the network
- Design for low maintenance by incorporating species which are native to the area and materials that are hard wearing and resistant to vandalism.

2.4 Alternatives and options considered

Alternatives and options for the proposal were identified and considered in developing the proposal. A description of each of the options considered and the methods for the selection of the preferred option is summarised in the following sections.

2.4.1 Methodology for selection of preferred option

Options assessment and review for the proposal was conducted throughout the larger Manns Road (Stockyard Place to Narara Creek Road) Stage 5 development, by a number of different methods including:

- Risk and opportunity workshop
- Value management workshop
- Health and safety in design workshop
- Constructability workshop.

At each stage of the options assessment process, a range of factors were considered which generally align with the broader Manns Road (Stockyard Place to Narara Creek Road) Stage 5 strategic objectives and the proposal objectives. These included:

- Improvements to the level of service, travel times and road user safety (including cyclists and pedestrians) for existing and future traffic scenarios
- Reducing property impacts including property access and acquisition

- Avoiding heritage impacts
- Avoiding or reducing flora and fauna impacts including impacts on the bushland area at the ridge
- Managing flooding and drainage impacts, including water quality and wetland impacts
- Constructability, including capacity to be constructed in stages
- Avoiding and reducing the extent of public utility impacts
- Urban design and visual impacts including earthwork on the ridge area.

The identified options for the proposal and an analysis of these options are provided in the following sections.

2.4.2 Identified options

No significant alternatives were investigated or apply to this proposal to upgrade the existing traffic lights and intersection at Narara Creek Road. However, the following three options were considered for the proposal:

- **Option 1 – do nothing.** Retain the existing intersection as it is
- **Option 2 – do minimal.** Retain the existing road layout but incorporate more formalised pedestrian and cycle facilities through lane markings and traffic lights
- **Option 3 – upgrade the intersection.** Upgrade the intersection by adding additional turning lanes and upgrade the northbound / southbound approach on Manns Road to two lanes in each direction.

2.4.3 Analysis of options

The intersection left in its current form (Option 1) or with minor changes to existing traffic lights and lane markings (Option 2) would not meet the current or projected growth in the area, has limited opportunities to further increase alternative transport options and limited capacity to provide for improved pedestrian and cycle connectivity and movements. However, Option 3 would improve safety for motorists, pedestrians and cyclists and improve existing congestion at the approaches to the intersection.

2.5 Preferred option

Option 3 was selected as the preferred option as it would enable the proposal objectives to be met including improved safety for motorists, pedestrians and cyclists and reducing congestion.

2.6 Design refinements

There have been no major design refinements since selection of the preferred option. The concept design of the preferred option is provided in Chapter 3.

3. Description of the proposal

3.1 The proposal

The proposal is to upgrade the intersection of Manns Road at Narara Creek Road and Maliwa Road, Narara. Manns Road is a state road (MR349) providing a critical north-south link between the M1 Pacific Motorway at Ourimbah and the Central Coast Highway at West Gosford.

The concept design is based on available information, site investigations and current Australian and Austroads standards and criteria. Some elements of the design may be further refined during detailed design. The main features are listed below and are shown in Figure 3-1:

- Providing an additional through lane on Manns Road northbound and southbound
- Providing an additional traffic lane on Maliwa Road to provide a dedicated left turn lane and combined through lane / right turn lane
- Providing an additional traffic lane on Narara Creek Road to provide dedicated left turn lane and combined through lane / right turn lane
- Lowering of an existing crest to improve the line of sight for vehicles approaching the intersection from the south
- Building a three metre wide shared pathway on the west of Manns Road from 110 metres south of the intersection to 260 metres north of the intersection and on both sides of Narara Creek Road for 60 metres from the intersection
- Providing 1.5 metre wide footpaths along the east of Manns Road north of the intersection and along the westbound verge of Maliwa Road
- Providing a central median on Manns Road from the intersection to about 200 metres north and 150 metres south
- Providing on-road cycle lane northbound and southbound on Manns Road
- Building a large rock-bolted wall extending to about 230 metres south of the intersection on the west side of Manns Road to accommodate the steep slope topography
- Upgrading and extending drainage infrastructure and stormwater management
- Removing the existing bus bay outside Glenvale School on Manns Road northbound, north of the intersection
- Relocating multiple public utility assets (including undergrounding some existing overhead electricity cables) to allow road widening for the intersection upgrade
- Adjusting property boundary fencing, service connections and driveways to accommodate the road upgrade.

Two construction compound areas and one small temporary stockpile location are proposed for the work, one located at the intersection of Manns Road and Carrington Street and the other on the southwest corner of the Dell Road and Manns Road intersection. Subject to approval, it is anticipated construction of the proposal would start in 2021 and would take about 12 to 18 months to complete, weather permitting.

The proposal has been designed to be able to be easily modified with limited future work, to tie into the strategic concept for the Stage 5 upgrade to the south, should it progress to further design and environmental assessment and construction.

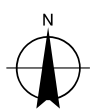
The concept design of the proposal is described in the Stockyard Place, West Gosford to Narara Creek Road, Narara Concept Design Report (GHD, 2018) and the following sections are summarised from that report.



LEGEND

	Proposal boundary		Verge		Median
	Concept design		Earthworks		Pavement

Paper Size A4
0 10 20 30 40
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Roads and Maritime Services
Manns Road Upgrade
Review of Environmental Factors
Narara Creek Road Intersection Upgrade

Job Number | 22-19033
Revision | 1
Date | 03 Oct 2018

Key features of the proposal

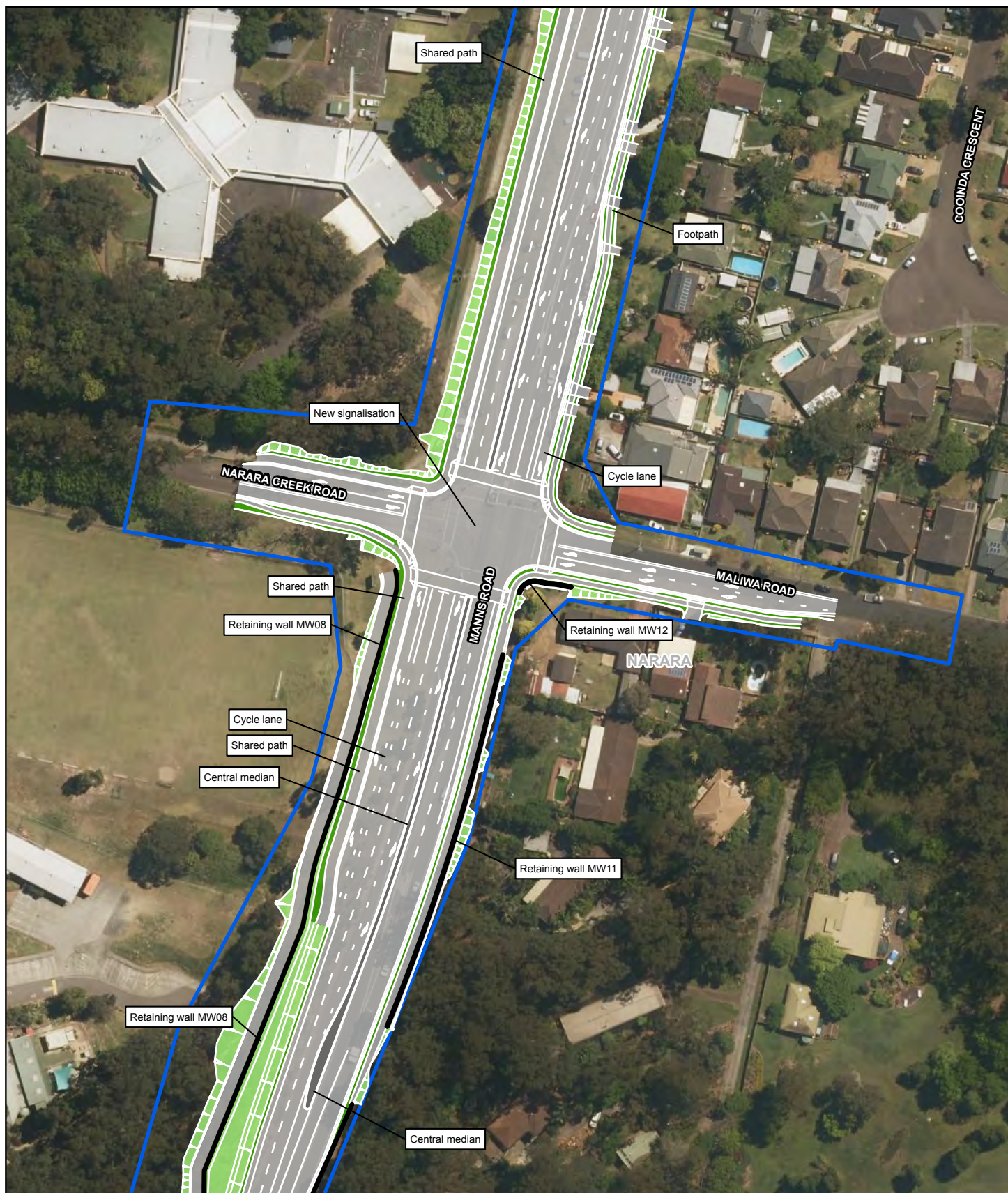
Figure 3-1a

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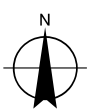
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LEGEND

Proposal boundary	Retaining wall	Earthworks
Concept design	Verge	Median
		Pavement

Paper Size A4
0 10 20 30 40
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Roads and Maritime Services
Manns Road Upgrade
Review of Environmental Factors
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Key features of the proposal

Figure 3-1b

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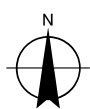
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LEGEND

Proposal boundary	Retaining wall	Earthworks
Concept design	Verge	Median
		Pavement

Paper Size A4
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Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Roads and Maritime Services
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Key features of the proposal

Figure 3-1c

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3.2 Design

A description of the concept design is provided in the following sections and is illustrated in Figure 3-1, Section 3.1. Concept design plans are included in Appendix A. The concept design would be further refined during the detailed design phase.

3.2.1 Design criteria

Standards

The concept design was prepared in accordance with the following:

- *Guide to Road Design – Austroads* (Austroads, 2009)
- *RTA Supplement to Austroads Guide to Road Design* (2011)
- *Road Design Guide* (Roads and Traffic Authority of NSW (undated))
- *Road Safety Audit Manual and Checklist* (Roads and Traffic Authority of NSW, 2005)
- *Beyond the Pavement, RTA urban design policy, procedures and design principles* (Roads and Traffic Authority of NSW, 2009)
- *Roads and Maritime Delineation Manual* (Roads and Maritime Services, 2012a)
- *Roads and Maritime Road Technical Directions*
- *NSW Speed Zone Guidelines* (Roads and Traffic Authority of NSW, 2011a)
- *Australian Standards: amended by Roads and Maritime Supplement* (Roads and Maritime Services, 2012b).

Design criteria

Key design criteria for the proposal are summarised in Table 3-1. For other elements such as medians, bus facilities and grades, Austroads requirements were followed and supplemented with Roads and Maritime and Central Coast Council requirements where applicable.

Table 3-1: Design criteria

Design element	Design criteria
Narara Creek Road Intersection	
Designed to accommodate vehicle size	19 metre semi-trailer
Manns Road	
Design speed south of Narara Creek Road	70 km/h
Design speed north of Narara Creek Road	60 km/h
Posted speed	60 km/h
Lane width south of Narara Creek Road	3.5 m
Lane width north of Narara Creek Road	3.3 m
Median width	1.8 to 5.7 m
Left turn auxiliary	3.5 m
Right turn auxiliary	3.2 m

Design element	Design criteria
Nearside (outside) shoulder width	1.5 m
Pedestrian path (eastern side for length of proposal)	1.5 m
Shared path (western side for length of proposal)	3 m
Median width at intersection	1.5 m
Side roads	
Design speed	60 km/h
Posted speed	50 km/h

Design life

The design life requirements for the proposal are defined in Table 3-2.

Table 3-2: Asset design life requirements

Asset	Minimum Design Life
Inaccessible drainage elements	100 years
Drainage elements which are accessible for refurbishment and maintenance including sedimentation and detention basins	40 years
Sign faces	10 years
Sign support structures and other roadside furniture	40 years
Fences including fauna fences	20 years
Lighting and electrical equipment	20 years
Bridge and Tunnel structures, including underpasses, overpasses and wildlife tunnels	100 years
Retaining Walls including rock bolted walls	100 years
Noise barriers, noise attenuation devices and headlight screens	50 years
Pavements Main carriageway including ramps Local roads	40 years 20 years
Local Road embankment and support structures	100 years
Embankments	100 years
Cut slopes, including slope treatments	100 years
Timber furniture	30 years
Other assets	Typical industry values for similar Assets of a high standard and quality
Intersection capacity improvements	20 years post opening

3.2.2 Engineering constraints

Engineering constraints have been identified through value engineering and constructability workshops. These constraints were considered during the design development and include:

- A narrow road reserve corridor for design and construction, particularly relocation of utilities
- Adjacent sensitive residential and educational receivers
- Steep crest to the west of Manns Road south of the intersection
- Close proximity to School infrastructure
- Grades on driveways for existing residential properties to the southeast of the intersection
- Provision of access to properties especially on the eastern side of the proposal
- Access and tie-in levels with local road alignments
- Managing existing drainage infrastructure during design and construction
- Construction near to and under existing overhead power cables
- Construction over / near a high pressure gas main and relocation of gas pressure regulator
- Construction over and near to below ground high voltage power cables.

3.2.3 Major design features

This section describes each of the design elements of the proposal as they apply to the following main design features. The concept design described in this REF has been guided by the design criteria discussed in Section 3.2, environmental and community issues and constraints, and the principles of ecologically sustainable development. Further design refinements are anticipated during detailed design. Concept design drawings are included in Appendix A.

Limit of work

The proposal is about 600 metres in length along Manns Road and 180 metres wide along Narara Creek Road/Maliwa Road. The limit of work to the north is about 50 metres south of Wananda Road and to the south it extends to about 460 metres north of Dell Road. To the east, the limit of work is about 130 metres west of Jirrang Road and the west limit is about 130 metres east of Kathryn Grove.

Road design

The traffic light controlled intersection at Narara Creek Road would be upgraded with amendments to reflect the new traffic lane arrangement allowing:

- Narara Creek Road eastbound intersection side:
 - Left turn lane onto Manns Road northbound
 - Combined through lane / right turn lane onto Maliwa Road eastbound and Manns Road southbound
- Manns Road northbound intersection side:
 - Right turn lane onto Maliwa Road eastbound
 - Two through lanes to continue on Manns Road northbound
 - Left turn lane onto Narara Creek Road westbound
- Maliwa Road westbound
 - Left turn lane onto Manns Road southbound
 - Combined through lane / right turn lane onto Narara Creek Road westbound and Manns Road northbound

- Manns Road southbound intersection side:
 - Right turn lane onto Narara Creek Road westbound
 - Two through lanes to continue on Manns Road southbound
 - Left turn lane onto Maliwa Road eastbound
- On-road cycle lane provision northbound and southbound on Manns Road
- Shared path (for use by both pedestrians and cyclists) on the western side of Manns Road
- Shared pedestrian and cycle crossing on the Maliwa Road side and pedestrian crossings on the remaining three sides.

The lane widths within the proposal footprint would be as follows:

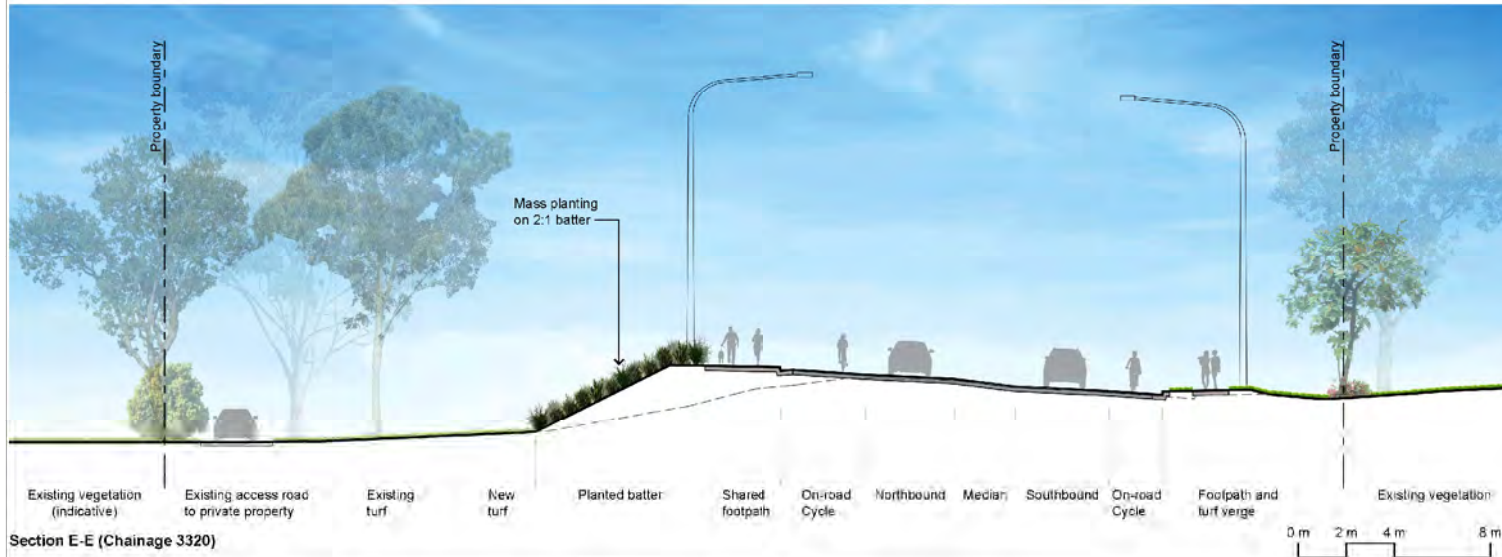
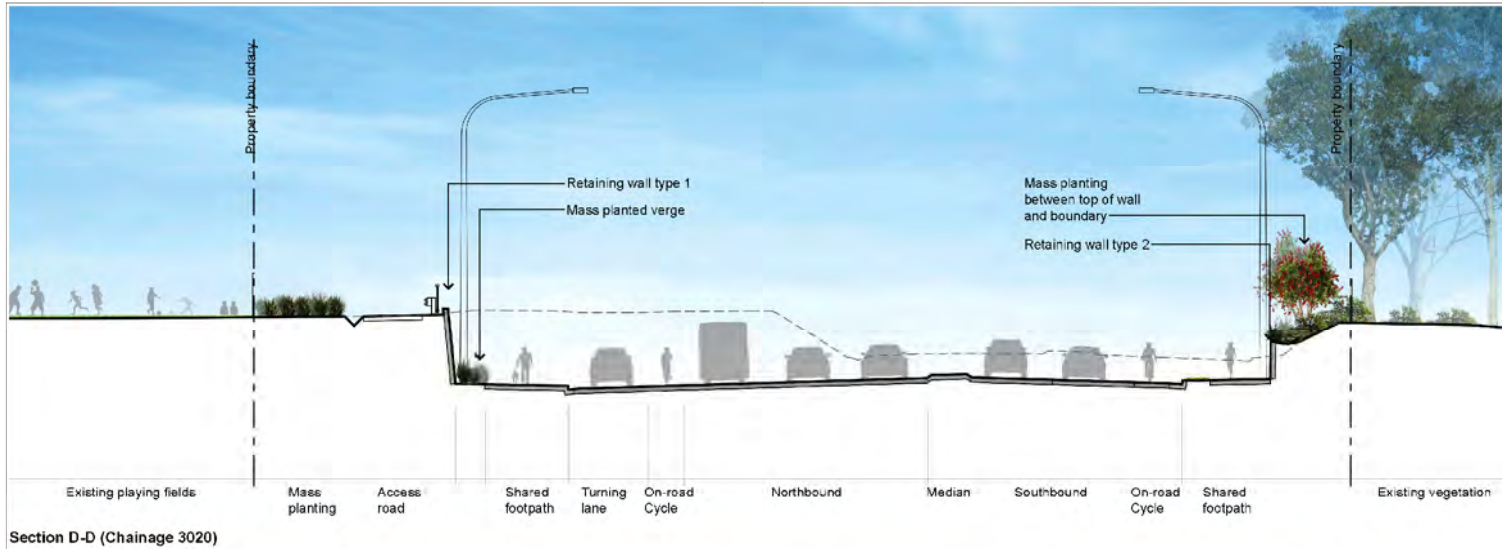
- 3.5 metre minimum width traffic lanes on Manns Road from the intersection south
- 3.3 metre minimum width traffic lanes on Manns Road from the intersection north
- 3.3 metre minimum width traffic lanes on Narara Creek Road and Maliwa Road within the proposal footprint
- 3.0 m minimum width turning lanes
- Typically 1.8 metre wide median from the intersection to about 200 metres north and 150 metres south.

The crest in Manns Road just south of the Narara Creek Road intersection has been reduced to achieve improved northbound approach sight distance to the intersection. As such, the slope of Narara Creek Road and Maliwa Road has also been adjusted to suit. A typical cross section is shown in Figure 3-2.

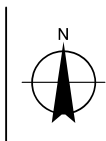
Standard slope of 4H:1V (four metres wide and one metre high) for areas of fill and 2H:1V for areas of cut have been adopted for the majority of the design. In constrained locations, such as to the south of the intersection, slightly steeper fill slopes of 3H:1V and retaining / rock bolted walls have been utilised to reduce the limit of work and environmental impact. Typically, barrier kerbs and gutter have been provided at the edge of road pavement, with local adjustment for driveways, footpath crossings and where a median has been provided. Raised barrier kerbs are proposed to be used for the central median to prevent vehicles crossing into opposing traffic lanes.

Appropriate signage and road marking would be provided to suit the proposal in accordance with Australian Standard 1743 and Roads and Maritime guidelines including R141 and road delineation guidelines.

Appropriate signage and line marking would be provided to suit the proposal in accordance with Australian Standard 1743 and Roads and Maritime guidelines including R141 and delineation guidelines.



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Typical cross sections

Figure 3-2

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Retaining walls

Four retaining walls / rock bolted walls are proposed within the proposal footprint, as described in Table 3-3 and shown in Figure 3-1 (Section 3.1). The size, extent and type of wall would be further refined during detailed design.

Table 3-3: Retaining / rock bolted walls

Aspect	Wall MW08	Wall MW10	Wall MW11	Wall MW12
Wall location	On the west of Manns Road, from the intersection southwards	On the east of Manns Road, from about 275 to 160 metres south of the intersection	On the east of Manns Road, from about 130 to 20 metres south of the intersection	On the south of Maliwa Road, extending from the corner with Manns Road to the east
Length	215 metres	116 metres	110 metres	15 metres
Height	0 to 11 metres	0.5 to 1.3 metres	0.4 to 2.5 metres	0.2 to 1 metres
Purpose	To allow road widening into the steep existing hillside	To allow for a proposed footpath above the nearby residential properties	To avoid acquisition of residential land above the proposed footpath	To avoid acquisition of residential land above the proposed footpath
Type	Given the presence of reasonable quality rock for the majority of the wall height, it is proposed to use a near-vertical rock-bolted wall system. This system is likely to require shotcrete facing in some locations to restrain rock wedges.	A reinforced concrete edge beam integrated with the concrete footpath is proposed	A reinforced masonry blockwork wall on top of a reinforced concrete footing is proposed	A reinforced masonry blockwork wall on top of a reinforced concrete footing is proposed
Comment	There would be an access track at the top of the rock-bolt wall with appropriate guard railing for maintenance access. A smaller wall may be required on the west of the access track to minimise the cut slope required due to the presence of the steep hillside. MW08 is conceptually shown in Figure 3-3.		Given the location close to the existing property boundary, temporary work to support the residential land is likely to be required	

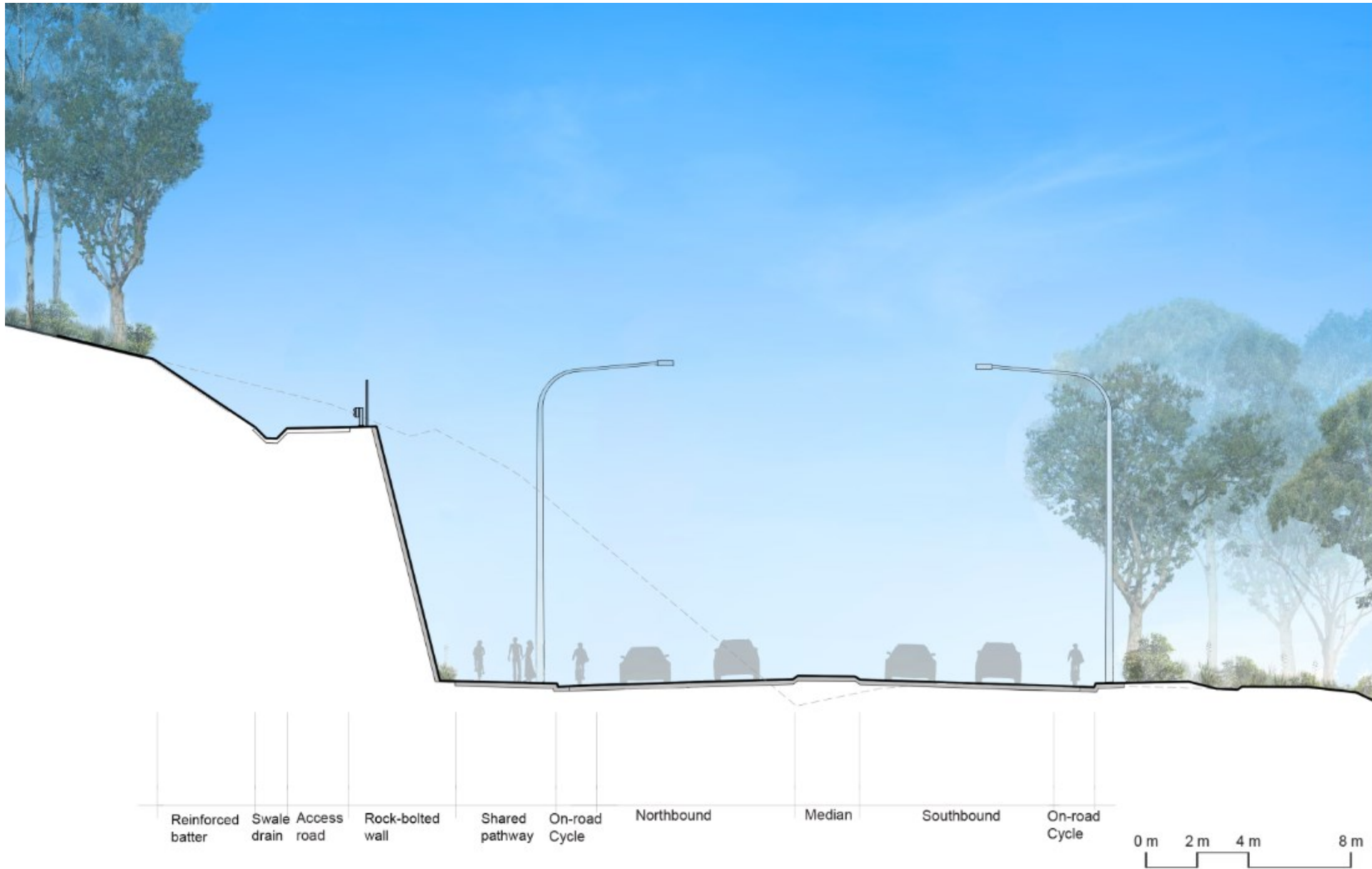


Figure 3-3: Conceptual visual of MW08

Cyclists and pedestrians

Provision for a minimum three metre wide shared path (for use by both pedestrians and cyclists) has been made on the western side of Manns Road through the extent of the proposal. On the eastern side of Manns Road and on Narara Creek Road and Maliwa Road, a 1.5 metre wide pedestrian footpath is provided. The width of the shared paths may be reduced where roadside barrier fences are required.

Provision for a 1.5 metre wide on-road cycle lane has also been made for the entire length of the proposal on Manns Road northbound and southbound.

Bus facilities

The proposal involves a combination of retaining and removing existing bus stops as summarised in Table 3-4. Roads and Maritime is carrying out ongoing consultation with bus companies to minimise potential impacts to bus services.

Table 3-4: Summary of bus stops

Location	Description
Manns Road northbound, north of the intersection adjacent to the Glenvale School	Asphalt bus bay with bus shelter to be removed
Maliwa Road eastbound about 50 metres from the intersection	Shelter and signpost to be retained in its current form
Maliwa Road westbound about 50 metres from the intersection	To be updated with a sealed shoulder and formalised footpath. The signpost would be retained, but due to space constraints no shelter is proposed.
Narara Creek Road westbound just outside the proposal footprint	No change as a result of the proposal

Stormwater drainage

The proposed drainage network has been designed to cater for a 10 year average recurrence interval (ARI) rain event. An upgrade of the main underground stormwater pipe along the southern side of Narara Creek Road and western verge of Manns Road is proposed, including increasing the pipe size and realigning the pipe to beneath the new kerb line. The upgrade is required to provide additional capacity and to avoid manholes being located in traffic lanes to prevent maintenance and other operational risks. This drainage upgrade would cater for the large external catchment area south of Narara Creek Road and east of Warooka Street, encompassing the ridge and land around St Philip's Christian College and would discharge flows to a drainage reserve via existing culverts opposite Wananda Road.

Elsewhere, there would also be an upgrade of the existing network to achieve the drainage standard as nominated by design specifications. New drainage is required along the eastern kerb alignment north of intersection, which would connect to a major underground pipe at the northern limit of work. New or upgraded stormwater pits are proposed in Maliwa Road at the intersection, which would connect to a drainage line on the east side of Manns Road.

South of the intersection, drainage would be provided on each side of the road following the proposed kerb alignment, which would outlet near an existing 750 millimetre diameter drainage pipe crossing under Manns Road. A new drain is to be provided along the rear of the access track above the retaining wall/rock bolted wall, to capture water flowing down the hillside at the large cutting south of Narara Creek intersection.

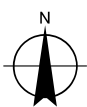
The proposed drainage infrastructure for the proposal is provided in Figure 3-4.

Cost estimate

Initial estimates have calculated the proposal would cost between 30 and 40 million Australian Dollars.



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Drainage design within the Proposal **Figure 3-4**

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3.3 Construction activities

3.3.1 Work methodology

Construction activities would be carried out in accordance with a construction environmental management plan to ensure work is carried out to Roads and Maritime specifications. Detailed work methodologies would be determined during detailed design and construction planning. A possible work methodology is described below noting the order of activities would vary to suit the final construction staging plans, which would be determined by the construction contractor and may change. Construction sequencing and methods would generally be as follows:

- Identify sensitive areas as defined by the REF, sensitive area maps and the construction environmental management plan
- Surveys, investigations and setting out work in accordance with design plans
- Mark trees that would need to be removed or trimmed, and mark any 'no-go' areas
- Install traffic management measures including temporary traffic signs and barricades
- Install temporary erosion, sediment and water quality controls, including silt fences, and stormwater diversion drains, with a focus on managing and diverting run-on water from higher areas away from the work
- Relocate, adjust, underground or protect existing utility services
- Clear and grub vegetation – noting that most vegetation clearing is restricted to the western verge on the southern approach to the existing intersection
- Identify suitable site topsoil and strip from work areas and stockpile (with controls to stabilise) for future use
- Import embankment, foundation and select materials and fill to the road formation levels
- Excavate slope to the south of the existing intersection and construct retaining structure
- Property adjustment work
- At property noise treatments (subject to further assessment during detailed design)
- Classify and dispose of unsuitable and/or surplus material from the proposal footprint
- Install new culverts and subsoil drains
- Install new kerb and gutter
- Construct the pavements, including placing and compacting select fill, base course, and asphalt wearing surface
- Construct tie-ins to existing roads
- Install new street lights
- Rehabilitate disturbed areas and landscape in accordance with the landscaping plan
- Line marking and sign posting
- Final site clean-up.

3.3.2 Construction staging

Construction of the proposal is anticipated to be conducted in two broad phases as follows:

Phase 1 – North of Narara Creek Road (Figure 3-5)

- Stage 1 – Footpath construction west side Manns Road
- Stage 2 – Full depth pavement construction west side of Manns Road, north side of Narara Creek Road
- Stage 3 – Footpath construction east side of Manns Road
- Stage 4 – Reconstruct pavement on east side of Manns Road in sub stages to maintain traffic flow
- Stage 5 – Construct concrete median island
- Stage 6 – Re-sheet pavement on east side of Manns Road in sub stages to maintain traffic flow

Phase 2 – South of Narara Creek Road (Figure 3-6)

- Stage 1 – Footpath and retaining / rock-bolted wall construction west side Manns Road
- Stage 2 – Full depth pavement widening west side of Manns Road
- Stage 3 – Footpath construction east side of Manns Road, removal existing median island
- Stage 4 – Reconstruct pavement on east side of Manns Road, south side of Narara Creek Road and Maliwa Road in sub stages to maintain traffic flow
- Stage 5 – Construct concrete median island
- Stage 6 – Re-sheet pavement on east side of Manns Road, south side of Narara Creek Road and Maliwa Road in sub stages to maintain traffic flow.

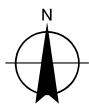
An indication of the potential staging of the construction is shown in Figure 3-5 and Figure 3-6, although this would be determined by the selected contractor so is indicative and conceptual only.



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| — Concept design | Stage 2 | Stage 5 |
| Construction staging | Stage 3 | Stage 6 |
| Stage 1 | Stage 4 | |

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Phase 1 – North of Narara Creek Road Figure 3-5

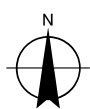
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— Concept design	Stage 2	Stage 5
Construction staging	Stage 3	Stage 6
Stage 1	Stage 4	

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Phase 2 - South of Narara Creek Road **Figure 3-6**

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3.3.3 Construction hours and duration

It is anticipated construction would start in about late 2021, subject to relevant approvals and funding. Construction would take about 12 to 18 months (weather permitting). Some elements of the proposal may be carried out as early work packages and could start ahead of the main contract work.

Potential early and enabling work may include minor demolition of structures, property adjustments following acquisition and significant public utility relocations such as overhead power. Early and enabling work would be investigated further in detailed design and be implemented with relevant safeguards as outlined in this REF.

It is anticipated construction would be largely carried out during standard construction working hours in accordance with the *Interim Construction Noise Guideline* (DECC, 2009):

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

However, the *Interim Construction Noise Guideline* (DECC, 2009) acknowledges the following activities have justification to be conducted outside the recommended construction hours:

- The delivery of oversized plant or structure
- Emergency work
- Work for which it can be demonstrated that there is a need to operate outside the recommended standard hours
- Work which maintain noise levels at receivers below the night time noise affected construction noise management levels.

To minimise disruption to daily traffic and disturbance to surrounding land owners and schools, it would be necessary to carry out some work outside of these hours. The following activities are likely to be conducted outside standard construction working hours:

- Removal of median islands at the existing intersection
- Milling and removal of the existing pavement on Manns Road through the intersection
- Placement of final (wearing) asphalt surface
- Tie-in activities on Manns Road to the north and south of the proposal
- Permanent line marking
- Stormwater drainage crossings
- Commissioning of traffic signals
- Road crossings and 'cut over' of relocated utilities to existing alignments outside the proposal footprint
- Installation and adjustment of barriers and signage for construction zones during each construction stage and switching of traffic between temporary lanes and routes through the proposal between stages.

Any work carried out outside of standard working hours would be in accordance with the *Interim Construction Noise Guideline* (DECC, 2009) and the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016). Prior advice would be given to the community if any work is planned to be carried out outside standard construction hours and the construction contractor would be required to prepare and implement an out of hours work procedure in accordance with Roads and Maritime guidelines.

3.3.4 Plant and equipment

A range of plant and equipment would be used during construction. The final equipment and plant requirements would be determined by the construction contractor. An indicative list of plant and equipment is as follows:

- Asphalt paver
- Backhoe
- Bulldozer
- Compressor
- Concrete pump truck
- Concrete saw
- Concrete truck
- Crane
- Dozer
- Dump trucks
- Excavator 20 Tonne
- Excavator 30 Tonne
- Excavator 40 Tonne
- Franna crane
- Front end loader
- Generators
- Grader
- Hand tools (electric and pneumatic)
- Light vehicles
- Road profiling machine
- Road truck
- Rock crusher
- Roller (15 Tonne)
- Vibratory roller
- Water cart
- Piling rig (bored)

3.3.5 Earthwork

The estimated quantities of materials associated with earthwork are provided in Table 3-5. Earthwork would include excavation of pavements and formation in the area of the rock bolted wall on the south western side of the Narara Creek Intersection. Earthwork requirements would be confirmed again during detailed design.

Table 3-5: Indicative earthwork quantities

Material	Indicative volume (cubic metres)
Top soil	2,100: 800 to be reused, 1300 to be disposed offsite
Cut to fill	19,500
Excavation of stormwater trenches including subsurface drainage	3,000
Excavation for utilities	5,000
Imported general fill	0
Imported select fill	4,200
Imported heavily bound material	14,000

3.3.6 Source and quantity of materials

The road pavement including select fill and heavily bound materials would be sourced from appropriately licensed facilities (quarries). About 1,600 cubic metres of road surfacing (asphalt) materials would be required to be imported. Imported materials would be sourced from commercial suppliers in nearby areas, wherever possible. As part of the concept design a preliminary assessment of potential sources of material has been completed which has identified suitable material is available at local quarries.

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

Construction of the proposal would require water for various purposes such as dust suppression, site amenities and landscaping. It is proposed water would be obtained from the local water supply network. The amount of water required during construction would be confirmed during detailed design.

3.3.7 Traffic management and access

Construction of the proposal would generate heavy vehicle movements. Heavy vehicle movements would mainly be associated with:

- Delivery of construction materials
- Spoil and waste removal
- Delivery and removal of construction equipment and machinery.

The main haul routes for the proposal would be Manns Road from the north and from the south, with an anticipated 50 per cent split from each direction. The estimated number of these heavy vehicle movements is shown in Table 3-6. Construction traffic would be prevented from hauling along local and minor roads. Haul routes would be defined in the Construction Traffic Management Plan (TMP).

Light vehicle movements would be required for the movement of construction personnel, including contractors, site labour force and specialist supervisory personnel (Table 3-6). Light vehicles used to transport staff to and from the site would park at the main site compound facility.

Table 3-6: Estimated construction vehicle movements

Number of movements	Heavy vehicles	Light vehicles
Average day time	90	170
Average night time	50	80
Peak day time (approximately one month duration)	140	230
Peak night time (approximately one month duration)	70	110

A detailed traffic management plan would be prepared in accordance with the Traffic Control at Work Sites Manual Version 5 (Roads and Maritime, 2018) and approved by Roads and Maritime before implementation. The traffic management plan would provide details of the traffic management to be implemented during construction to ensure traffic flow on the surrounding network is maintained where possible. It is not anticipated there would not be any full road closures or diversions during the work and traffic flow through the intersection would be managed via lane closures and staging.

Property access would be maintained as far as practicable throughout construction and there would be no disruption to bus routes.

3.4 Ancillary facilities

Site compound facilities and laydowns would include portable buildings with amenities (such as lunch facilities and toilets), secure and bunded storage areas for site materials, including fuel and chemicals, office space for on-site personnel, and associated parking.

Two potential compound/laydown sites and one temporary construction area are being investigated for use during construction of the proposal as shown on Figure 3-7. These include (from north to south):

- Compound 1 – located at the intersection of Manns Road and Carrington Street, about 550 metres north of the proposal. It is positioned on vacant grassed land under private ownership
- Temporary construction area – a gravelled area of about 550 square metres within the road verge of Manns Road, about 300 metres south of the proposal
- Compound 2 – located about 500 metres south of the proposal, on the southwest corner of the Dell Road and Manns Road intersection. This lot comprises an existing motor registry office owned by Roads and Maritime.

The potential impacts associated with these locations have been assessed in this REF. Stockpile locations would be further refined during the detailed design phase using the criteria set out in the Stockpile Management Guideline (RTA, 2011).

3.4.1 Site selection

The four potential sites have been selected with consideration to the following criteria:

- Near to the proposal footprint
- Not prone to excessive flooding and avoids drainage lines

- Relatively flat ground which does not require substantial reshaping
- Minimal disturbance to sensitive receivers
- In plain view of the public to deter theft and illegal dumping.

Should the construction contractor select alternative compound sites, these criteria would be used to assess their suitability for the proposal.

3.4.2 Use and operation

Compounds 1 and 2 would be used for the following potential activities:

- Site facilities including office space, amenities, and lunch room
- Light vehicle parking
- Chemical storage
- Storage of bulk materials, equipment and machinery, including fuel storage
- Storage of earthwork materials.

The temporary construction area is small and would primarily be used for the temporary storage of equipment, temporary parking and minor stockpiles, particularly those associated with night work due to the proximity of the site to the proposal.

The compound and site laydown areas would operate while the proposal is being built. This would include some limited out of hours operation when the related weekend and night work takes place (refer to Section 3.3.3).

Clearing of vegetation for the establishment operation of compound sites would be limited to grasses, weeds and minor native vegetation regrowth. Both the construction compound and stockpiling area would operate for the duration of construction. To the extent practicable, those sites used for stockpiling would be established, operated and decommissioned consistent with the recommended work practices in the Roads and Maritime Stockpile Site Management Guideline (Roads and Maritime, 2011a).

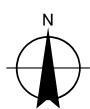
Sites would be securely fenced with temporary fencing. Signage would be erected advising the general public of access restrictions. Upon completion of construction, the temporary site compounds and associated work areas and stockpiles would be removed, the site cleared of all rubbish and materials, and the area rehabilitated.



LEGEND

- Proposal footprint
- Concept design
- Compound
- Watercourse

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Potential compound sites

Figure 3-7

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3.5 Public utility adjustment

Consultation with public utility authorities has been carried out as part of the development of the concept design to identify and locate existing utilities and incorporate utility authority requirements for relocations and/or adjustments. Preliminary investigations have indicated the following existing utilities and corresponding authorities were found to be within the extents of the proposal:

- Overhead and underground electricity
- Water reticulation
- Sewer reticulation
- Telecommunications
- Gas reticulation (high and medium pressure).

Consultation with utility owners is ongoing and would continue throughout the detailed design phase. The final location of any relocated utilities is still subject to this consultation and has not been defined to date. The proposal footprint for the REF has been defined to allow for the anticipated location of all relocated or adjusted utilities.

A public utilities strategy report has been developed for the proposal and would inform the detailed design phase. Main utilities impacted by the proposal are summarised in Table 3-7. A brief overview of the location is given only as many utilities criss-cross through the study area and connect to local networks. Further assessment of utility locations and the extent of relocations within the proposal footprint will be finalised in detailed design.

Table 3-7: Utilities located in the study area

Utility	Provider	Description and location
Electricity	Ausgrid	<ul style="list-style-type: none"> • Aboveground 11kV transmission line on western side of Manns Road throughout the proposal footprint • Aboveground 11kV transmission line on eastern side of Manns Road throughout the proposal footprint • Low voltage transmission line on northern side of Maliwa Road • 11kV and low voltage transmission line on northern side of Narara Creek Road
Gas	Jemena	<ul style="list-style-type: none"> • Secondary gas regulator southeast of the intersection in Maliwa Road • 150 mm diameter high-pressure (1050kPa) secondary gas main located along Manns Road for the full extent of the proposal footprint • 110 mm medium pressure (210kPa) service main on northern side of Narara Creek Road and part of Maliwa Road. The main crosses Maliwa Road east of secondary regulator and continues on southern side to the east • 50 mm medium pressure (210kPa) service main on southern side of Maliwa Road providing connection from secondary main and regulator.
Water	Central Coast Council	<ul style="list-style-type: none"> • 100 mm diameter pipe on northern side of Narara Creek Road/Maliwa Road
Sewer	Central Coast Council	<ul style="list-style-type: none"> • North of Narara Creek Road/Maliwa Road intersection, a 225 diameter sewer is located on eastern side of Manns Road through to Wananda Road running along Manns Road • 150 diameter sewer on southern side of Maliwa Road starting at bus bay and heading east (away from Manns Road)

Utility	Provider	Description and location
Telecommunications	Telstra	<ul style="list-style-type: none"> Single conduit crossing Maliwa road (north – south). Conduit size P100. P100 conduits run through intersection of Narara Creek Road/Maliwa Road east – west with pits within intersection.
	NBN	<ul style="list-style-type: none"> NBN pits and conduits are located on the eastern side of Manns Road between Dell Road and Narara Creek Road. NBN conduit continues through Narara Creek Road intersection on eastern side of Manns Road. NBN conduits join at northeast corner of Maliwa Road/Manns Road intersection.

3.6 Property acquisition

The proposal would require partial acquisition of property as shown in Table 3-8 and Figure 3-8. The extent of property acquisition would be confirmed during detailed design. Land acquisition would be carried out in accordance with the *Land Acquisition Information Guide (Roads and Maritime 2014)* and the *Land Acquisition (Just Terms Compensation) Act 1991*. Roads and Maritime would carry out ongoing consultation with all affected landholders.

Table 3-8: Proposed property acquisition

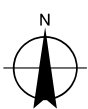
Lot and DP	Property	Land use	Total area (ha)	Area of lot directly impacted (ha)
Lot 1 DP122572	Glenvale School	R2 (Low density residential)	2.9	0.009
Lot 1 DP236409	Residential property	R2 (Low density residential)	0.064	0.001
Lot 102 DP832279	St Philip's Christian College	SP2 (Infrastructure)/DM (Deferred matter)	10.862	0.203
Lot 111 DP703141	Residential property	R2 (Low density residential)	0.123	0.007



LEGEND

- Property impacted
- Impacted area
- Retaining wall
- Cadastre
- Design
- Watercourse

Paper Size A4
 0 10 20 30 40
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



Roads and Maritime Services
 Manns Road Upgrade
 Review of Environmental Factors
 Narara Creek Road Intersection Upgrade

Job Number 22-19033
 Revision 1
 Date 03/10/2018

Impacted property

Figure 3-8

G:\22\19033\GIS\Maps\Pro\2219033_MannsRoad\REF_NararaCreek_1.aprx

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com.au

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Data source: LPI: DTDB / Aerial Imagery, 2017. Created by:tmorton

4. Statutory and planning framework

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

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

Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent. As the proposal is for road infrastructure facilities and is to be carried out by Roads and Maritime, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required.

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

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

State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP)

State Environmental Planning Policy (Coastal Management) 2018 updates and consolidates into one integrated policy, the former SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection), including clause 5.5 of the Standard Instrument – Principal Local Environmental Plan. These policies are now repealed.

The Coastal Management SEPP gives effect to the objectives of the *Coastal Management Act 2016* from a land use planning perspective, by specifying how development proposals are to be assessed if they fall within the coastal zone. Coastal Management SEPP defines the four coastal management areas in the Act through detailed mapping and specifies assessment criteria which are tailored for each coastal management area. Councils and other consent authorities must apply these criteria when assessing proposals for development which falls within one or more of the mapped areas.

The proposal does not directly impact areas identified as 'coastal wetlands' or 'littoral rainforest' on the Coastal Wetlands and Littoral Rainforests Area Map. In addition, the proposal is not mapped on land which is within proximity to coastal wetlands or littoral rainforest.

However, the majority of the proposal (including all compound locations) is located on land identified as a coastal environment area. Division 3, Clause 13 of the Coastal Management SEPP outlines requirements for development on land within the coastal environment area and specifically the aspects which must be considered by the consent authority before granting development consent for a coastal environment area.

About 100 metres of the southern portion of the proposal is also situated within land mapped as a coastal use area. The temporary construction area, as well as Compounds 1 and 2 are also completely within this coastal use area. Division 3, Clause 14 of the Coastal Management SEPP outlines requirements for development on land within the coastal use and considerations for the consent authority before granting development consent.

Considerations of the coastal environment area and coastal use area and potential adverse impacts have been addressed in the following Sections:

- Section 6.2 – Biodiversity
- Section 6.7 – Hydrology and flooding
- Section 6.7 – Surface water
- Section 6.11 – Groundwater
- Section 6.9 – Aboriginal heritage
- Section 6.11 – Non-Aboriginal heritage
- Section 6.4 – Landscape character and visual impacts

Site-specific safeguards and management measures are provided in Section 7.2. These measures would mitigate the identified potential impacts and subsequently address the criteria identified by Division 3 (Clause 13 and 14) under the Coastal Management SEPP.

State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP 44)

The *State Environmental Planning Policy 44 – Koala Habitat Protection* (SEPP 44) encourages the conservation and management of natural vegetation areas which provide habitat for koalas to ensure permanent free living populations are maintained over their present range.

The policy applies to land within local government areas listed under Schedule 1 of the SEPP. The proposal is located wholly within the former Gosford local government area, which now forms part of the Central Coast local government area. Gosford local government area is listed under Schedule 1 and therefore the policy applies to the proposal.

SEPP 44 requires before granting consent for development on land over one hectare in area, a consent authority must be satisfied as to whether or not the land is 'potential' and 'core' koala habitat. These are defined as follows:

- 'Core Koala Habitat' is an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings and historical records of a population
- 'Potential Koala Habitat' is an area of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15 per cent of the total number of trees in the upper or lower strata of the tree component.

No evidence of koalas were recorded within the proposal footprint, and the proposal does not include core koala habitat as defined in the SEPP. This is discussed further in Section 6.2.

4.1.2 Local Environmental Plans

The proposal is located wholly within the former Gosford local government area, which now forms part of the Central Coast local government area. There is no current local environmental plan for the Central Coast local government area, therefore, the *Gosford Local Environmental Plan 2014* (the LEP) applies to the proposal. The proposal footprint is within five different land use zones under the LEP. The provisions of the LEP provide the proposal would be permitted with consent under the zones within the proposal footprint (Table 4-1).

For the small area of land zoned DM, these lands retain their 7(a) Conservation or 7(c) Scenic Protection zone from the previous plan.

Table 4-1: Gosford LEP zoning

Land use zone	Location	Consistency with the LEP objectives
SP2: Infrastructure	Existing Manns Road corridor	Yes – The proposal provides infrastructure and is compatible with the desired future character of the zone
R2: Low density residential	Along the east of Manns Road throughout the proposal footprint and on the west of Manns Road north of the intersection. Also includes Narara Creek Road and Maliwa Road.	Yes – Upgrading the intersection would provide a facility which meets the day to day needs of residents by improving safety and reducing congestion.
DM: Deferred matter	West of Manns Road south of the intersection next to St Philip's Christian College	N/A
RE1: Public Recreation	Compound 1	Yes – The temporary compound location would be rehabilitated to its previous form post construction to ensure the land is compatible with the desired future character of the zone.
IN1: General Industrial	Compound 2	Yes – Upgrading the road supports and improves access to and from this industrial area.

However, Clause 5.12 of the LEP states '*...this Plan does not restrict or prohibit, or enable the restriction or prohibition of, the carrying out of any development, by or on behalf of a public authority, that is permitted to be carried out with or without development consent, or that is exempt development, under State Environmental Planning Policy (Infrastructure) 2007*'.

As the proposal is permitted without consent under ISEPP (Section 4.1), the consent requirements of the LEP do not apply.

4.2 Other relevant NSW legislation

4.2.1 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) establishes the procedures for issuing licences for environmental protection in relation to aspects such as waste, air, water and noise pollution control. The owner or occupier of premises engaged in scheduled activities is required to hold an environment protection licence and comply with the conditions of that licence.

Under Part 3.2 of the POEO Act, the carrying out of scheduled development work as defined in Schedule 1 requires an environmental protection licence.

Schedule 1, Clause 19 (extractive industries) specifies land-based extractive activity is considered a scheduled activity if it involves the extraction, processing or storage of more than 30,000 tonnes per year of extractive materials. There is potential the proposal would involve the excavation of more than 30,000 tonnes of earthwork material during construction (Section 3.3.5), which would align with the definition of a land-based extractive activity under Clause 19 and trigger the need for an EPL. An EPL would be further assessed and where necessary applied for in Detailed Design, following calculation of final earthwork quantities.

Section 6 of the POEO Act indicates the EPA is the appropriate regulatory authority for development by public authorities, which would be Roads and Maritime for the proposal. Roads and Maritime would be required to notify the EPA immediately of any 'pollution incident' is likely to have an impact on the environment.

4.2.2 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NP&W Act) aims to conserve nature, objects, places or features (including biological diversity) of cultural value within the landscape. The NP&W Act also aims to foster public appreciation, understanding and enjoyment of nature and cultural heritage, and provides for the preservation and management of national parks, historic sites and certain other areas identified under the Act. The NP&W Act is administered by the NSW Office of Environment and Heritage (OEH).

A search of the Aboriginal Heritage Information Management System (AHIMS) database on 30 November 2017 revealed no Aboriginal heritage items or places which have previously been recorded within the proposal footprint (including a buffer zone of 250 metres). One registered Aboriginal site was identified within the broader search area, AHIMS site (45-3-0561) however it would not be impacted by the proposal footprint.

Section 6.9 includes further information on the potential for impact on items protected under the *National Parks and Wildlife Act 1974* including a preliminary Aboriginal cultural heritage assessment for the proposal carried out in accordance with Stage 2 of the Roads and Maritime *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (Roads and Maritime, 2011).

4.2.3 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. The proposal footprint does not contain any protected marine vegetation, such as seagrass, mangroves or saltmarsh and there is no instream work proposed. The proposal footprint was assessed for the potential presence of threatened aquatic species and concluded there is no potential for impacts to threatened aquatic species.

One of the objectives of the FM Act is to 'conserve key fish habitats', which includes aquatic habitats which are important to the maintenance of fish populations generally and the survival and recovery of threatened aquatic species.

Key fish habitat recorded or likely to occur within and around the proposal footprint is detailed further in Section 6.2. The biodiversity assessment concluded the proposal would not cause a significant impact to key fish habitats and therefore a Part 7 fisheries permit application is not required.

4.2.4 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) came into effect on 25 August 2017 and replaces the *Threatened Species Conservation Act 1995*, *Native Vegetation Act 2003* and NP&W Act (animal and plant provisions only); and makes amendments to the *Local Land Services Act 2013* (LLS Act).

Public authorities may elect to include a biodiversity development assessment report (BDAR) for development under Part 5 of the EP&A Act, and to be subject to the new biodiversity offsets scheme. Alternatively Section 7.3 of the BC Act requires a test of significance for determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. If a test of significance determines the proposal would result in significant impacts to threatened biota, a Species Impact Statement is required.

Threatened biota recorded or likely to occur in the proposal footprint are detailed further in Section 6.2. Tests of significance (Assessments of Significance) have been prepared under Section 7.3 of the BC Act for one threatened species identified in the proposal footprint, and three other threatened species with a moderate likelihood of occurring in the proposal footprint. These assessments found the proposal would not cause significant impacts to threatened species, and a Species Impact Statement or BDAR is not required.

4.2.5 Water Management Act 2000

The *Water Management Act 2000* aims to ensure water resources are conserved and properly managed for sustainable use benefitting both present and future generations. It also provides formal protection and enhancement of the environmental quality of waterways and in-stream uses as providing protection of catchment conditions. The *Water Management Act 2000* applies where a water sharing plan, issued under the Act, has started.

The proposal is located within areas subject to the following water sharing plans:

- Water Sharing Plan for the Central Coast Unregulated Water Sources 2009
- Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016
- Relevant approvals under the Act include water use approvals (Section 89), water management work approvals (Section 90) and activity approvals (Section 91).

Water use approvals

Section 56 of the Act establishes access licences for the taking of water within a water management area. Clause 18 (1) identifies the instances where a person is exempt from Section 60A (1) and (2) of the Act in relation to the taking of water from a water source.

Schedule 5 Part 1 (2) of the *Water Management (General) Regulation 2011*, states Roads and Maritime, as a roads authority, is exempt from the need to obtain an access licence in relation to water required for road construction and road maintenance.

Water management work approvals

Water management work approvals are required for water supply work, drainage work and flood work. The proposal does not constitute water supply work but does include the upgrade of drainage infrastructure to manage overland flows and prevent inundation of the road. However, under Clause 41E(2) of the *Water Management (General) Regulation 2011*, Roads and Maritime, as a roads authority, is exempt from the need to obtain a water management work (flood work) approval if it constructs or uses a flood work for the purposes of a public road.

Activity approvals

Activity approvals are required when a certain activity is likely to affect waterfront land (controlled activity approval) or interfere with an aquifer (aquifer interference approval). Clause 38 of the *Water Management (General) Regulation 2011* provides Roads and Maritime, as a roads authority, is exempt from requiring controlled activity approval for all controlled activities it carries out in, on or under waterfront land.

The aquifer interference approval requirements of the *Water Management Act 2000* have not yet started and aquifer interference is still regulated under the *Water Act 1912*.

4.2.6 Water Act 1912

The *Water Act 1912* facilitates development and use of water, by controlling the extraction of water, the use of water, the construction of work, such as dams and weirs, and the carrying out of activities in or near sources in NSW. Part 5 of the *Water Act 1912* applies to water supply work or aquifer interference approvals within the meaning of that Act.

As discussed in Section 6.11, groundwater dewatering is not likely to be required. A licence from DPI Water for groundwater dewatering during construction would therefore not be required. Should groundwater be intercepted or should the construction contractor have the need to establish bores for the purposes of investigation, extraction, dewatering, testing or monitoring, an aquifer interference approval would be obtained from the relevant agency prior to the installation of the bores.

4.2.7 Biosecurity Act 2015

The *Biosecurity Act 2015* aims to manage biosecurity risks from animal and plant pests and diseases, weeds and contaminants. The Act provides for modern, flexible tools and powers which allow effective, risk-based management of biosecurity in NSW.

Amongst other things, the Act provides for the declaration of priority weeds and biosecurity zones by the Minister for Primary Industries. The Act also lists plant pests and diseases which are prohibited and notifiable in NSW.

One priority weed species was recorded in the proposal footprint: Lantana (*Lantana camara*). Legal requirements to minimise the potential for the introduction and/or spread of weeds as a result of the proposal are discussed in Section 6.2.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) a referral is required to the Australian Government for proposed actions which have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. These are considered in Appendix B and Chapter 6 of the REF.

The assessment of the proposal's impact on matters of national environmental significance and the environment of Commonwealth land found there is unlikely to be a significant impact on relevant matters of national environmental significance or on Commonwealth land.

A referral is not required for proposed road activities which may affect nationally listed threatened species, endangered ecological communities and migratory species. This is because requirements for considering impacts to these biodiversity matters are the subject of a strategic assessment approval granted under the EPBC Act by the Australian Government in September 2015.

The assessment of the proposal's impact on nationally listed threatened species, endangered ecological communities and migratory species found there is unlikely to be a significant impact on relevant matters of national environmental significance. Potential impacts to these biodiversity matters are also considered as part of Chapter 6 of the REF and Appendix B.

4.3.2 Other relevant Commonwealth legislation

Native Title Act 1993

The *Native Title Act 1993* recognises and protects native title. It provides that native title cannot be extinguished contrary to the Act. Essentially, this Act covers actions affecting native title and the process for determining whether native title exists and compensation for actions affecting native title.

A Native Title search was carried out of the National Native Title Tribunal on 3 December 2017 identified no determined native title determinations within the proposal footprint.

4.4 Confirmation of statutory position

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

Roads and Maritime is the determining authority for the proposal. This REF fulfils Roads and Maritime's obligation under Section 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity. Consent from Central Coast Council is not required.

5. Consultation

5.1 Consultation strategy

A community and stakeholder engagement plan has been prepared for the Manns Road upgrade – Stockyard Place, West Gosford to Narara Creek Road, Narara of which this proposal is a part. The plan demonstrates Roads and Maritime's commitment to meeting the reasonable needs and desires of the community for information and considering its views on the proposal.

The communication and engagement objectives for the proposal, as contained in the plan, are to:

- Provide regular and targeted information to the community and stakeholders on the progress of the proposal and construction activities, including the likely impacts and benefits
- Provide clear direction to the community and stakeholders on whether we are providing information or seeking feedback so expectations are clear
- Ensure community and stakeholder feedback and issues are considered in the decision-making process
- Ensure issues relating to project delivery are identified early and managed effectively
- Manage stakeholder feedback and complaints in a timely, respectful way
- Monitor and evaluate stakeholder feedback and communication activities to measure success, and review planning and delivery as required
- Collaborate with government agencies and local council to ensure a whole-of-government approach to managing issues and providing consistent messages
- Build stakeholder and community confidence in Roads and Maritime and its decisions.

Initial stakeholder engagement through a “have your say” and display of strategic design plans has been conducted for the larger Stage 5 planning, including this proposal in early development. This will continue to be delivered for this proposal through a number of communication methods including, but not limited to:

- Community updates and newsletters
- Website updates and information
- Notification letters
- Media releases
- Advertisements (print and broadcast)
- Drop-in and door-knocking sessions
- Use of a proposal-specific email, resourced phone number and mail address.

This review of environmental factors is on display for comment between 20 May 2019 and 14 June 2019. Roads and Maritime will then respond to this feedback in the form of a submissions report. Concerns, issues and solutions arising from the submissions report will contribute to the development of a detailed design for this proposal.

While the proposal is being built, road users, businesses and the community would be kept informed ahead of planned traffic changes, night work, lane closures and detours by using message signs onsite, website information, bulk-distribution emails and letterbox drops. Those residents, school communities businesses and landowners that would potentially be directly affected by the work would be notified and kept informed of work impacts including noise. Notification methods would include contact by phone, email and by holding face-to-face meetings to discuss specific issues such as driveways, bus stops and school set down and gate access.

5.2 Community involvement

Community consultation has been carried out as part of the wider program to upgrade the Pacific Highway and Manns Road on the Central Coast (Stages 1 to 5). The Roads and Maritime website provides community updates relating to the Stage 5 work, which includes Manns Road between Stockyard Place, West Gosford and Narara Creek Road, Narara.

Roads and Maritime is committed to working with stakeholders and the community during the planning process. Information regarding the work is progressively updated as the proposal progresses. For more information, please visit <http://www.rms.nsw.gov.au/projects/central-coast/west-gosford-to-narara/index.html>

The proposal is currently in concept design and Roads and Maritime has carried out ongoing targeted consultation with Central Coast Council and other key stakeholders including affected land owners, business owners and utility providers. Roads and Maritime has consulted with the owners of the public and private land which would be partially acquired as part of the proposal (Section 3.5). As required, feedback from this consultation has been incorporated into the proposal.

Wider consultation activities were carried out in May 2016, to inform community members and stakeholders about the broader Stage 5 planning from Stockyard Place to Narara Creek Road and includes the proposal at Narara Creek Road intersection. Activities included:

- Letters to directly affected stakeholders and community within the larger Stage 5 area
- Community update, newspaper advertisements and information sessions.

Additional consultation and engagement was carried out in October and November 2017 for the early development of concept designs, including:

- Doorknocking and face-to-face meetings with 73 stakeholders and community within and around the proposal footprint, which included businesses and residents
- Phone calls to stakeholders and community within and around the proposal footprint.

The outcome of the consultation with the community to date is discussed in the socio-economic section of this report (Section 6.3) and within the Socio-economic Impact Assessment (Appendix E (Volume 2)). During initial display of the strategic design for the overall Stage 5 project, key issues raised by the public included:

- Access constraints due to the inclusion of a raised central median and locations to safely turn around
- Safety of roads users, including pedestrians and cyclists, during and after construction
- Concerns which the upgrade would result in further congestion of Manns Road.

The above issues all related to the overall Stage 5 project and no specific issues were raised in relation to the proposal (Narara Creek Road intersection).

5.3 Aboriginal community involvement

Consultation with local Aboriginal stakeholders has been carried out in accordance with the Roads and Maritime *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI) (Roads and Maritime 2011) and Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW 2010).

Representatives from the Darkinjung Local Aboriginal Land Council (DLALC) were involved in the Aboriginal heritage assessment investigations and provided vital information about the Aboriginal cultural heritage of the region. DLALC did not express any objections to the proposal. A copy of the PACHCI is located in Appendix F (Volume 2). One issue was raised by the DLALC representatives, although this related to a site located near Dell Road which is some distance outside of the proposal footprint and boundary and more relevant to the ongoing strategic development for the larger Stage 5. No other issues were raised during the Aboriginal community consultation. No other issues were raised during the Aboriginal community consultation.

There are no approved native title determinations over the proposal footprint.

5.4 ISEPP consultation

Central Coast Council has been consulted about the proposal as per the requirements of clause 13 and 15 of ISEPP via letter, dated 28 February 2018. This is due to the potential impacts on stormwater infrastructure, flood liable lands, road excavation and associate construction-phase traffic. An email response was received from Central Coast Council on 29 March 2018.

Appendix C contains an ISEPP consultation checklist which documents how ISEPP consultation requirements have been considered. It also contains a copy of the letters which have been issued as part of the statutory consultation for the proposal. Key items raised by Central Coast Council are outlined in Table 5-1 along with a response.

Table 5-1: ISEPP consultation with Central Coast Council

Issue raised	Response/where addressed in REF
Manns Road is an identified cycle route and the provision for both on-road and off-road cycle lanes is considered a high priority	The proposal would provide both on-road and off-road cycle lanes, as discussed in Section 3.2.
Manns Road is a bus route and the upgrade should consider disability access to all bus stops and shelters at stops which are frequently used	Bus facilities would be adjusted as part of this proposal as discussed in Section 3.2.3.
Any road work should not adversely impact on drainage secondary flow paths	The proposal incorporates flow paths to minimise impact on drainage as discussed in Chapter 3.
Or raise flood level by more than 10 millimetres	The proposal would not impact flood immunity, as discussed in Section 6.1.
Any impact on Council's local road network must be approved by Council's representative	Central Coast Council would be consulted at each design stage and before display to advise of any proposed traffic changes.
Any impact of Council's water and sewer services must be reviewed and approved by Council's representative	Utility adjustment is discussed in Section 3.5.

5.5 Government agency and stakeholder involvement

5.5.1 Government agencies

The following Government agencies were consulted for the Manns Road Upgrade – Stockyard Place to Narara Creek Road, including this proposal:

- NSW Department of Primary Industries (Fisheries)
- Department of Planning and Environment.

Appendix D contains a copy of the letters which have been issued as part of the consultation for the proposal and relevant responses. Key aspects which were raised during consultation with these agencies are outlined in Table 5-2.

Table 5-2: Issues raised through government agency consultation

Agency	Issue raised	Response/where addressed in REF
NSW Department of Primary Industries	<p>Ensuring fish stocks are conserved and there is no net loss of key fish habitats upon which they depend.</p> <p>Fisheries NSW has no objections to the proposal, provided:</p> <ul style="list-style-type: none"> • Environmental safeguards (silt curtains, booms etc.) are used during the work to ensure there is no escape of turbid plumes into the adjacent aquatic environment • Fisheries NSW (1800 043 536) and the Environment Protection Authority (131 555) are notified immediately if any fish kills occur close to the work. In such cases, all work other than emergency response procedures are to cease until the issue is rectified and approval is given by Fisheries NSW and/or the Environment Protection Authority for the work to proceed. 	<p>There are no waterways impacted by this proposal. This issue mostly relates to the broader strategic development of the Manns Road Upgrade – Stockyard Place to Narara Creek Road which is not being assessed as part of this REF</p>
Department of Planning and Environment	<p>The Department supports this proposal, and suggests Roads and Maritime consider the recent NSW Government Architects work regarding Gosford City, specifically the document titled <i>GOSFORD - Urban Design and Implementation Framework</i>. http://gogosford.engagementhq.com/</p> <p>In this document the connectivity of Gosford City to its neighbouring areas is explored and encouraged. Emphasis is given to connecting pedestrians from Gosford City to the industrial areas of West Gosford through alternative east west links, potentially over Narara Creek.</p>	<p>Issues addressed in the Urban Design Report and Sections 6.4, 6.3 and 7.2.</p> <p>The issue of connectivity over Narara Creek to the east is outside the scope of this proposal which is limited to the Narara Creek Road Intersection and will be explored in the future as part of any development of the larger Stage 5 strategic design.</p>

Agency	Issue raised	Response/where addressed in REF
	Additional work has been conducted by both the Department and Central Coast Council on the opportunities for growth within the defined 'Southern Corridor', which runs from Somersby in the west to Erina in the east. West Gosford is identified within this corridor as being an industrial centre, with the aims of the corridor to improve access to and through these centres and to allow surrounding communities to access services and infrastructure more effectively.	

5.5.2 Stakeholders

Meetings with community facilities, emergency service providers and Gosford Erina and Coastal Chamber of Commerce were conducted during February 2018. The purpose of the meetings was to gain an understanding of the existing facility or service, its users, and any potential impacts to the facility, service or users as a result of the proposal.

Issues which have been raised as a result of consultation with these stakeholders are outlined in Table 5-3, and in a Socio-economic Impact Assessment is provided in Appendix E (Volume 2).

Consultation with public utility authorities has been carried out as part of the development of the concept design to identify and locate existing utilities and incorporate utility authority requirements for relocations and/or adjustments. Consultation with utility owners is ongoing and would continue throughout the detailed design phase.

Table 5-3: Issues raised through stakeholder agency consultation

Stakeholder	Issue raised	Response/where addressed in REF
Glenvale School	<ul style="list-style-type: none"> Glenvale School is a special needs school catered to students with moderate to severe disability Access to the school is through the driveway on Narara Creek Road There is limited parking on Narara Creek Road and no car park within the school site The school receives 30 buses daily transporting students. Buses range from vans to long-wheeled buses. School buses are often queued up along Narara Creek Road before school starts. Due to the disability needs of students, the school supervises and manages bus drop-offs and pick-ups. Buses are not allowed to enter the school until there is supervision on site The school is used by the community outside of hours The construction of the proposal may disrupt access of school buses along Narara Creek Road as a result of increased construction traffic and lack of parking. They considered this would lead to stress among students with a disability. 	Issues addressed in Sections 6.3, 7.2 and in the attached SEIA Report.

Stakeholder	Issue raised	Response/where addressed in REF
St Philip's Christian College	<ul style="list-style-type: none"> • Within the site, there is a primary school, school for specific purpose (Dale Campus), and preschool. Students travel from suburbs including Narara, Wyong, Woy Woy, Terrigal, Karing and Gosford • The Dale Campus caters for children with a disability. Some students require assisted transport to Dale Campus • Students and parents can only access the school via the Narara Creek Road driveway. Congestion is an issue at the intersection of Manns Road and Narara Creek Road. The school receives cars, assisted transport vehicles and school buses on site • The school oval is located on the north-eastern corner of the site, fronting Manns Road and Narara Creek Road. The oval is used by students, schools events and external sporting clubs (outside of school hours) • The construction of the proposal may impact the safety of children as many walk to school • Noise and visual impacts from construction activities may affect students who are using the school oval. Given the proposal footprint is directly adjacent to the oval and construction workers may work in the area during school hours, they would like construction staff to have Working with Children checks and be aware of appropriate language and behaviour around children • Increased traffic and congestion during construction would affect access for local residents. Access to the school should be maintained throughout construction and any diversions should consider the access of school buses and pedestrian safety and access. 	Issues addressed in Sections 6.8 6.1, 6.4 6.3, 7.2 and in the attached SEIA Report.
C3 Church	<ul style="list-style-type: none"> • C3 Church is used by various community groups, including playgroups, mother's group and youth group during the week. Church services are held on Sunday mornings and Friday nights once a month • The proposed central median would have a minor impact on the access of some of its users who drive from the north of Manns Road and turn right into their facility. On the other hand, the central median could discourage some of its users from crossing Manns Road and instead cross at the intersection of Manns Road and Narara Creek Road • The operation of the proposal would improve traffic flow and visual amenity, benefiting the community in the long term. 	Issues addressed in Sections 6.8, 6.3, 7.2 and in the attached SEIA Report.

Stakeholder	Issue raised	Response/where addressed in REF
Rural Fire Service NSW	<ul style="list-style-type: none"> • The proposal footprint is not within their jurisdiction. Fire & Rescue NSW (FRNSW) typically responds to emergencies within the proposal footprint • While the Rural Fire Service may access Manns Road during emergencies, it is not considered a significant emergency route • The construction of the proposal would have a minor impact on their services • During operation, Rural Fire Service considered the proposal would improve traffic flow, benefiting the community. 	No issues raised
NSW Police	<ul style="list-style-type: none"> • The construction of the proposal would have a minor impact on their services • They considered the operation of the proposal would improve traffic flow. 	No issues raised
Fire and Rescue NSW	<ul style="list-style-type: none"> • Manns Road is a main emergency route • The closest Fire and Rescue NSW facilities are located in Kariong, Wyoming and Gosford. Gosford Fire Station typically responds to motor vehicle crashes within the proposal footprint • The construction of the proposal would have a minor impact on their services. They noted if the proposed central median is high or incorporates fencing, it may be a barrier for emergency vehicles if they require right-turn access to properties along the proposal footprint in an emergency. They recommended any fencing should provide access points for emergency vehicles • Any road changes should be communicated to the local emergency management committee • The operation of the proposal would increase traffic flow and improve safety for the community. It would also improve emergency access to surrounding suburbs, such as Narara and Ourimbah • The proposed central median would improve road safety by limiting the turning traffic along Manns Road. 	Issues addressed in Sections 6.3, 7.2 and in the attached SEIA Report.

Stakeholder	Issue raised	Response/where addressed in REF
NSW Ambulance	<ul style="list-style-type: none"> Manns Road is a key access route. If Manns Road is partially closed, alternate routes include Showground Road and the Pacific Highway The closest ambulance facility is located at Point Clare, within the North Sydney/Central Coast district. Emergency vehicles are also stationed at Gosford Hospital, which will typically service West Gosford The construction of the proposal would have a minor impact on ambulance services, as they generally receive information from Roads and Maritime or contractors regarding significant roadwork or road changes. They also do not expect any impacts on community safety The operation of the proposal would improve traffic flow and response times for emergency vehicles, benefiting the community in the long term. 	Issues addressed in Sections 6.3, 7.2 and in the attached SEIA Report.

5.6 Ongoing or future consultation

This section describes the ongoing and future consultation would take place during and following the REF display and during construction, should the proposal be approved to proceed.

5.6.1 Response to submissions

This REF will be placed on public display for comment by Government agencies, stakeholders and the community. Following the public display period, Roads and Maritime will collate submissions and respond to the comments.

After considering the submissions, Roads and Maritime will determine whether the proposal should proceed as described or whether any alterations are necessary. It will also decide if additional environmental assessment has to be carried out or additional environmental safeguards or management measures need implementing.

A community update advising the community and stakeholders of the outcome of consultation will be distributed and Roads and Maritime will also meet with affected residents, businesses and other stakeholders.

5.6.2 Detailed design and pre-construction consultation

If the proposal is built, the community consultation and stakeholder engagement plan (refer to Section 5.1) would be updated to support the detailed design and pre-construction stages to ensure:

- There would be an integrated response to traffic management including provision for emergency vehicle access at all times while the proposal is being built
- Any necessary detours would be effectively managed to reduce impacts to general traffic and public transport
- Suitable and appropriate environmental safeguards and management measure refinements are made to account for design changes and refinements

- Ongoing meetings with Central Coast Council and other relevant stakeholders, including government agencies, utility providers, adjacent landowners, business owners and community stakeholders
- Relevant project information is available and updated regularly on the Roads and Maritime website.

5.6.3 Construction consultation

The appointed construction contractor would also be required to consult with the local community before and while the proposal is being built. This process would be managed through the construction environmental management plan (CEMP, refer to Section 7.1). It would include:

- Issuing notices before starting work and relaying information on traffic management controls, temporary road closures, temporary access restrictions and planned noisy activities
- Door-knocking with affected residents
- Ongoing consultation with affected parties comprising meetings, letter-drops, posters and notifications.

All ongoing consultation would be carried out by Roads and Maritime in accordance with the Roads and Maritime's *Community Involvement Practice Notes and Resource Manual* and the project specific stakeholder engagement plan (Roads and Maritime, September 2016).

6. Environmental assessment

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

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

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

6.1 Noise and vibration

A summary of the noise and vibration methodology, existing environment, impacts and mitigation measures are provided in the following sections, while a detailed noise report is provided in Appendix G (Volume 2).

6.1.1 Methodology

A noise and vibration assessment was conducted to quantify the noise and vibration impacts associated with the proposal. The assessment was conducted with consideration to the following key guidelines:

- Noise Criteria Guideline (Roads and Maritime Services 2014) and application notes
- Noise Mitigation Guideline (Roads and Maritime Services 2014)
- Road Noise Policy (DECCW 2011)
- Model Validation Guideline (Roads and Maritime Services 2016)
- Construction Noise and Vibration Guideline (Roads and Maritime Services 2016)
- Environmental Noise Management Manual (Roads and Traffic Authority 2001)
- Interim Construction Noise Guideline (DECC 2009)
- German Standard DIN 4150, Part 3: Structural Vibration in Buildings: Effects on Structures
- British Standard BS 6472: 2008, Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting
- British Standard BS 5228-2:2009, Code of practice for noise and vibration on construction and open sites – Part 2: Vibration
- Assessing Vibration: A Technical Guideline (DEC 2006)
AS 2702 Acoustic Methods of Measurement of Road Traffic Noise
- AS 1055 Acoustics – Description and Measurement of Environmental Noise.

Further detail on the methodology for noise and vibration for construction and operation phase impacts is provided under Sections 6.1.3 and 6.1.4.

6.1.2 Existing environment

The existing noise environment was assessed through monitoring at selected locations within the proposal footprint to measure the existing road traffic noise and the background and ambient noise environment. The results provided a basis for validation of the noise model and the development of proposal specific noise criteria. Long-term unattended noise monitoring was conducted between 23 February 2018 and 10 March 2018 at two locations considered to be representative of the local noise environment (Figure 6-1).

Identified receivers within the study area were identified and grouped into two noise catchment areas, NCA1 and NCA2. NCA1 encompasses receivers to the west of Manns Road, while NCA2 comprises those to the east. NCA1 and NCA2 are predominantly residential, while NCA1 also includes two schools and a place of worship. Receivers within each noise catchment area are expected to experience similar existing background noise levels based on the results of site observations and the background noise monitoring. Sensitive receivers, noise catchment areas and monitoring locations for the proposal are shown on Figure 6-1.

A summary of the monitoring results (with all invalid weather affected data removed) from the unattended monitoring are provided in Table 6-1 and Table 6-2. The noise environment was dominated by the existing road traffic noise from Manns Road. Other identified noise sources in the area included birds, insects, noise from residential activities and noise from schools.

Table 6-1: Summary of background noise levels, rating background level 90th percentile dB(A)

Noise logging location	Day L _{A90} (15min)	Evening L _{A90} (15min)	Night L _{A90} (15min)
NCA1 – L01: 90 Manns Road	48	39	33
NCA2 – L02: Glenvale School	44	42	42

Note 1: NPI defines day, evening and night-time periods as:

- Day: the period from 7 am to 6 pm Monday to Saturday; or 8 am to 6 pm on Sundays and Public Holidays
- Evening: the period from 6 pm to 10 pm
- Night: the period from 10 pm to 7 am.

Table 6-2: Summary of road traffic noise descriptors – equivalent sound pressure level dB(A)

Noise logging location	L _{Aeq} (15hr) (7 am to 10 pm weekdays)	L _{Aeq} (9hr) (10 pm to 7 am weekdays)	L _{Aeq} (1hr) Day	L _{Aeq} (1hr) Night
NCA1 – L01: 90 Manns Road	64	57	65	62
NCA2 – L02: Glenvale School	60	53	62	56

6.1.3 Operation assessment

Methodology

An operational noise assessment has been conducted to quantify the noise and vibration impacts resulting from operation of the proposal, which would predominantly comprise noise generated from the passing traffic. Operational noise modelling for the proposal was carried out for the following scenarios:

- Existing 2018 – the current year existing noise model was used to verify the operational noise model. It considered data obtained from the road traffic noise monitoring and simultaneous traffic counts
- Future year traffic, ten years from the original base case – ‘Build’ 2026 and ‘no build’ 2026
- Future year traffic, twenty years from the original base case – ‘Build’ 2036 and ‘no build’ 2036.

The ‘no build’ (or ‘do nothing’) scenarios are required to assess the change in total traffic noise associated with the proposal (i.e. the ‘build’ scenario).

Criteria

The *Noise Criteria Guideline* (Roads and Maritime, 2014) establishes a consistent approach to the application of the *Road Noise Policy* (DECCW, 2011) to Roads and Maritime projects.

Using this guideline, the relevant noise criteria for residential and non-residential land uses applying to this proposal are shown in Table 6-3. Most buildings provide a noise reduction of at least 10 dB(A) when windows are left 20 per cent open, without providing additional treatment. Therefore where the noise goals are internal, a 10 dB(A) reduction from external noise levels to internal noise levels has been adopted to allow for an external assessment.

There is also a cumulative limit criteria from the Noise Criteria Guideline (Roads and Maritime Services, 2014), which is triggered if a sensitive receiver is predicted to exceed the Noise Criteria Guideline by five dB(A) or more in the build year, even if this exceedance is not directly caused by the proposal. The purpose of the cumulative limit is to prevent a sensitive receiver with an existing high noise level that exceeds the noise criteria guideline from remaining at this high noise level after the proposal is opened.

Table 6-3: Road traffic noise assessment criteria

Existing sensitive land use	Criteria, day (dB(A)) 7am – 10pm	Criteria, night (dB(A)) 10pm – 7am	Additional considerations
Residential	60 $L_{Aeq}(15hr)$	55 $L_{Aeq}(9hr)$	
School classrooms	$L_{Aeq,1hour}$ 40 (internal) when in use	–	In the case of buildings used for education or health care, noise level criteria for spaces other than classrooms and wards may be obtained by interpolation from the ‘maximum’ levels shown in <i>Australian/New Zealand Standard 2107:2000 Acoustics – Recommended design sound levels and reverberation times for building interiors</i> .

Existing sensitive land use	Criteria, day (dB(A)) 7am – 10pm	Criteria, night (dB(A)) 10pm – 7am	Additional considerations
Places of worship	L _{Aeq,1hour} 40 (internal) when in use	L _{Aeq,1hour} 40 (internal) when in use	The criteria are internal. Areas outside the place of worship, such as a churchyard or cemetery may also be a place of worship. Compliance with internal criteria inside the church may be sufficient; however for external areas passive recreation criteria (Open space – active use) may also be applied.
Open space (active use)	L _{Aeq,15hour} 60 (external) when in use	-	Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants making them less sensitive to external noise intrusion.
Open space (passive use)	L _{Aeq,15hour} 55 (external) when in use	-	Passive recreation is characterised by contemplative activities which generate little noise and where benefits are compromised by external noise intrusion, for example playing chess, reading.

Sleep disturbance criteria

The road noise policy provides a literature review for the assessment of sleep arousal due to traffic noise, however, does not set a sleep disturbance assessment criterion. Sleep disturbance impacts are likely to be dependent on the following:

- Maximum noise level of an event
- Number of occurrences
- Duration of the event
- Level above background or ambient noise levels.

For continuous rather than intermittent traffic flow, the *Environmental Noise Management Manual* (RTA, 2001) recommends L_{Amax} noise pass-by events should not exceed L_{Aeq (1hr)} noise levels by more than 15 dB(A). The *Environmental Noise Management Manual* (RTA, 2001) advises maximum noise levels can be used as a tool to prioritise and rank mitigation strategies, but should not be applied as a decisive criterion in itself.

Noise levels measured at L01 are representative of the residential dwellings fronting Manns Road where maximum noise levels due to pass by events along Manns Road are the highest. The sleep disturbance criteria for this proposal using the above methodology is therefore L_{AFmax} 77 dB(A).

Operational noise impact

The operational noise assessment outcomes summarised in Table 6-4 identified up to 37 sensitive receivers potentially qualify for mitigation consideration under the NMG. These receivers can be further broken down into:

- 19 residential receivers
- 2 place of worship buildings
- 16 educational buildings.

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The exceedances were due to these receivers exceeding the cumulative limit criteria. The cumulative limit criteria is exceeded due to existing high noise levels at these receivers as the existing noise levels are 5 dBA over the criteria.

For all the receivers that exceed the controlling criterion but do not exceed the cumulative limit criteria, the total noise levels do not increase by more than 2.0 dBA as result of construction of the proposal. Therefore, these receivers do not qualify for noise mitigation.

Table 6-4: Receivers qualifying for mitigation consideration¹

Receiver ID	Receiver Type	Criteria, dBA		Predicted noise level for 2026, dBA		Exceedance, dBA	
		L _{Aeq} (15hr)	L _{Aeq} (9hr)	L _{Aeq} (15hr)	L _{Aeq} (9hr)	L _{Aeq} (15hr)	L _{Aeq} (9hr)
R00718	Residential	60	55	67	61	7	6
R00741	Residential	60	55	67	60	7	5
R00758	Place of worship building	48	-	61	55	13	-
R00771	Residential	60	55	66	60	6	5
R00776	Place of worship building	48	-	55	48	7	-
R00793	Residential	60	55	67	60	7	5
R00819	Residential	60	55	66	59	6	-
R00844	Residential	60	55	66	59	6	-
R00870	Residential	60	55	66	59	6	-
R00882	Educational building	48	-	58	51	10	-
R00884	Educational building	48	-	64	58	16	-
R00888	Educational building	48	-	59	52	11	-
R00892	Residential	60	55	66	60	6	5
R00914	Educational building	48	-	55	49	7	-
R00917	Educational building	48	-	62	55	14	-
R00922	Residential	60	55	66	59	6	-
R00940	Residential	60	55	66	59	6	-
R00958	Educational building	48	-	63	56	15	-
R00971	Residential	60	55	66	59	6	-
R00994	Residential	60	55	66	59	6	-
R01019	Residential	60	55	66	59	6	-
R01034	Residential	60	55	66	60	6	5
R01054	Residential	60	55	66	60	6	5
R01074	Residential	60	55	65	59	5	-
R01086	Residential	60	55	66	59	6	-
R01099	Educational building	48	-	53	46	5	-
R01109	Educational building	48	-	55	49	7	-
R01127	Educational building	48	-	53	46	5	-
R01134	Residential	60	55	67	61	7	6
R01140	Residential	60	55	66	59	6	-
R01141	Educational building	48	-	54	48	6	-
R01155	Educational building	48	-	54	47	6	-

¹ Note for non-residential receivers, criteria are presented as an external L_{Aeq}(15hr). Internal L_{Aeq}(1hr) levels have been converted based on a 10 dBA façade reduction façade and internal levels have been converted L_{Aeq}(15hr) levels based on noise logger results

Receiver ID	Receiver Type	Criteria, dBA		Predicted noise level for 2026, dBA		Exceedance, dBA	
		L _{Aeq} (15hr)	L _{Aeq} (9hr)	L _{Aeq} (15hr)	L _{Aeq} (9hr)	L _{Aeq} (15hr)	L _{Aeq} (9hr)
R01178	Educational building	48	-	53	46	5	-
R01184	Educational building	48	-	57	50	9	-
R01195	Educational building	48	-	56	49	8	-
R01209	Educational building	48	-	53	47	5	-
R01215	Educational building	48	-	61	55	13	7

A noise barrier was not considered feasible due to the presence of direct driveway access to Manns Road. Mitigation measures for sensitive receivers which qualify for mitigation consideration under the NMG may include a range of in-property or architectural controls, building facade treatments and/or low noise pavement options. Facade noise testing would be required at the educational buildings and places of worship to calculate the actual performance of the building facades and further assess compliance with the Roads and Maritime NCG levels and the extent of treatment required. During the detailed design phase, further noise testing should be done at the worst-affected facade for the educational buildings and the place of worship buildings shown in Table 6-4.

Sleep disturbance impact

Based on the detailed noise assessment results in Appendix G (Volume 2), the current maximum noise levels exceed the L_{Aeq}(1hr) noise levels by more than 15 dB(A) and are above 65 dB(A) during the night time. General deductions based on the maximum noise level results can be made:

- Due to the updated road configuration shifting to the west, the residential receivers along the eastern side of Manns Road are predicted to receive a marginal reduction in maximum noise levels
- Receivers along the western side of Manns Road are predicted to receive a marginal increase in maximum noise levels. It should be noted that the majority of receivers along the western side of Manns Road are educational buildings and place of worship buildings and will not be impacted by potential sleep disturbance
- The maximum increase in maximum noise levels is 1.2 dB(A) and is not likely to result in a discernible difference in perceived noise levels.
- The prediction of maximum noise levels for new roads possess a reasonable level of uncertainty. However, sleep disturbance impacts are not likely to significantly differ from existing conditions.

More information regarding this assessment is detailed in Section 4.4.8 of the specialist noise assessment in Appendix G (Volume 2).

6.1.4 Construction assessment

Construction noise methodology

A construction noise assessment has been conducted to quantify the potential noise impacts resulting from construction of the proposal. Noise levels for the proposal have been predicted at nearby sensitive receivers using CadnaA noise modelling software.

The noise modelling has been carried out to provide a worst case scenario as it assesses the maximum noise level of an activity when it is closest to any given receiver. Construction noise levels would vary depending on the location and operation of an individual piece of construction equipment or machinery. Therefore, the overall noise level experienced at a particular receiver location would vary with time and would typically be less than the maximum presented values. Using the indicative construction staging (Section 3.3.2) and experiences from similar projects in the past, the proposal is anticipated to involve the following general work methodology, which is grouped into the following separate scenarios for the purposes of predicting noise levels:

- Scenario 1 (SO1) - Mobilisation and site establishment
- S02 – Utility, property, service adjustment
- S03 – Widen verge and form footpath
- S04 – Install new full depth pavement at western widening
- S05 – Install new full depth pavement at eastern widening
- S06 – Install new kerb and gutter, driveways and footpath
- S07 – Install new medians
- S08 – Asphalt re-sheet and line marking
- S09 – Compound set-up
- S10 – Compound operations
- S11 – Compound removal
- S12 – Temporary compound operation
- S13 – Retaining / rock bolted wall construction.

Each scenario contains a range of standard road construction activities predicted to occur, including vegetation clearing, earthwork, concrete work, and so on. A detailed description of the activities assessed under each scenario is provided in Table 5-14 of the specialist report in Appendix G (Volume 2).

Construction noise criteria

Construction noise criteria were developed in accordance with the *Interim Construction Noise Guideline* (DECC, 2009) for each noise catchment area.

Construction of the proposal is expected to generally occur during standard construction hours. Standard hours as defined in the guideline are:

- 7am to 6pm Monday to Friday
- 8am to 1pm on Saturday
- No work on Sundays or public holidays.

However, the Interim Construction Noise Guideline acknowledges the following activities have justification to be carried out outside the recommended construction hours:

- The delivery of oversized plant or structure
- Emergency work
- Work for which it can be demonstrated there is a need to operate outside the recommended standard hours
- Work which maintain noise levels at receivers below the night time noise affected construction noise management levels.

To minimise disruption to daily traffic and disturbance to surrounding land owners and schools, it would be necessary to carry out some work outside of these hours. The following activities are likely to be conducted outside standard construction working hours:

- Removal of median islands at the existing intersection

- Milling and removal of the existing pavement on Manns Road through the intersection
- Placement of final (wearing) asphalt surface
- Tie-in activities on Manns Road to the north and south of the proposal
- Permanent line marking
- Stormwater drainage crossings
- Commissioning of traffic signals
- Road crossings and 'cut over' of relocated utilities to existing alignments outside the proposal footprint
- Installation and adjustment of barriers and signage for construction zones during each construction stage and switching of traffic between temporary lanes and routes through the proposal between stages.

Any work carried out outside of standard working hours would be in accordance with the Interim Construction Noise Guideline (DECC, 2009) and the Construction Noise and Vibration Guideline (Roads and Maritime Services, 2016). Prior advice would be given to the community if any work is planned to be carried out outside standard construction hours and the construction contractor would be required to prepare and implement an out of hours work procedure in accordance with Roads and Maritime guidelines.

The noise management levels apply to sensitive residential receivers within each noise catchment area during construction of the proposal are presented in Table 6-5.

Table 6-5: Summary of construction noise management levels at sensitive residential receivers, L_{Aeq} dB(A)

Time	NCA1	NCA2
During standard recommended hours		
Highly noise affected	75	75
Noise affected	58	54
Outside of standard recommended hours (OOHW)		
Day 7am to 8am and 1 pm to 6pm Saturday, 8am to 6pm Sunday & public holidays	53	49
Evening 6pm to 10pm Monday to Sunday & public holidays	44	47
Night 10pm to 7am, Monday to Saturday; 10pm to 8am Sunday & public holidays	39	47

Notes:

- The 'noise affected level' represents the measured background noise levels plus 10 dB(A) during standard construction hours
- The 'noise affected level' represents the measured background noise levels plus 5 dB(A) outside of standard construction hours
- The 'highly noise affected level' represents the point above which there may be strong community reaction to noise. This level is set at $L_{Aeq(15min)}$ 75 dB(A).

The construction noise management levels which apply to other sensitive non-residential receivers (when they are operating) in the study area are:

- Schools and places of worship – 45 dB(A) internal noise level
- Active recreation – 65 dB(A) external noise level
- Commercial/industrial receivers – 70 dB(A) external noise level.

The highly affected noise level of $L_{Aeq(15min)}$ 75 dB(A) also applies to all sensitive non-residential receivers.

Construction traffic criteria

The Road Noise Policy (DECCW, 2011) provides traffic noise target levels for receivers near existing roads. These levels are applied to construction work to identify potential construction traffic impacts and the subsequent need for reasonable and feasible mitigation measures.

For the assessment of impacts it has been reasonably assumed the majority of the proposal would be constructed with traffic and access maintained along Manns Road and the surrounding local road network. The applicable criteria relating to noise due to additional traffic generated during construction of the proposal is therefore the same as provided in Table 6-3 under operational noise assessment (Section 6.1.3).

The exception is that residential receivers that face onto local roads such as Narara Creek Road and Maliwa Road have a slightly lower criteria of 55 dB(A) for the day and 50 dB(A) for the night time, reflecting the lower general traffic volumes that exist on these road as opposed to the busier Manns Road.

Based on the Road Noise Policy (DECCW, 2011) it is considered where road traffic noise levels already exceed the assessment criteria, an increase of less than 2 dB(A) represents a minor impact is barely perceptible to the average person.

Construction vibration methodology

Safe buffer distances for vibration activities associated with the proposal have been calculated using the following methodology:

- Typical vibration levels for difference plant have been sourced from the *Environmental Noise Management Manual* (ENMM) (2001), British Standard *BS 5228.1 Code of Practice for noise and vibration control on construction and open sites: Part 2 Vibration* and the *Construction Noise Strategy* (Transport for NSW 2012)
- Safe working distances have been calculated to comply with the structural damage criteria (heritage and standard structures) and the human comfort criteria detailed below.

Construction vibration Criteria

Human comfort

Vibration has been assessed based on the criteria provided in the *British Standard (BS) 6472 – 1992, Guide to Evaluation of Human Exposure to Vibration in Buildings* (provided in the attached technical noise report, Appendix G (Volume 2)), which is recognised as the preferred standard for assessing 'human comfort criteria'.

Humans are capable of detecting vibration at levels well below those causing risk of damage to a building. The degrees of perception for humans are suggested by the vibration level categories given in *BS 5228.2 – 2009, Code of Practice for noise and vibration on construction and open sites – Part 2: Vibration*, as shown in Table 6-6. Due to the variable nature of vibration magnitudes and unknown duration of exposure for this proposal, guidance from BS 5228-2 (which uses a peak vibration value) has been used to provide an indication of potential human comfort impacts.

Table 6-6: Guidance on effects of vibration levels for human comfort (BS 5228.2 – 2009)

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely vibration at this level in residential environments would cause complaints, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure.

Structural damage

Currently, there is no Australian Standard sets the criteria for the assessment of building damage caused by vibration. Cosmetic damage criteria are provided in *German Standard DIN 4150-3: 1999-02 Structural Vibration – Part 3: Effects of vibration on structures*. This assessment has applied the DIN 4150-3: 1999 criteria and these levels are summarised in Table 6-7.

Table 6-7: DIN 4150-3: 1999 Guideline values for short-term vibration on structures (mm/s)

Type of structure	Vibration at the foundation at a frequency of:		
	1 to 10 Hz	10 to 50 Hz	50 to 100 Hz ¹
Buildings used for commercial purposes, industrial buildings, and buildings of similar design.	20	20 to 40	40 to 50
Dwellings and buildings of similar design and/or occupancy.	5	5 to 15	15 to 20
Structures which, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (for example listed buildings under preservation order).	3	3 to 8	8 to 10

Note 1: At frequencies above 100 Hz, the values given in this column may be used as a minimum value.

Construction noise impacts

This section provides a summary of the construction noise impacts predicted for the proposal; based on Section 5.4 of the specialist noise assessment provided in Appendix G (Volume 2) which has the full details of project specific construction noise management levels, number of exceedances and maximum exceedance for residential and non-residential receivers.

The number of exceedances of the trigger levels of the construction noise and vibration guidelines for each noise catchment area are presented in Table 6-8 for standard hours and Table 6-9 for OOHW night period. The results show construction activities would result in a short-term increase in localised noise levels, particularly for sensitive residential and sensitive non-residential receivers located close to the proposal site.

The magnitude of the off-site noise impact associated with construction activities would be dependent upon a number of factors, namely:

- The intensity and location of construction activities
- The type of equipment used
- Existing local noise sources
- Intervening terrain
- Time and duration of construction activities
- The prevailing weather conditions.

It is highly unlikely all construction equipment would be operating at their maximum sound power levels at any one time and certain types of construction machinery would be present in the proposal footprint near to the receiver for only brief periods during construction activities. As a result, the following findings represent a maximum noise level based on the noise modelling and are not necessarily representative of the continuous impact over a construction period.

The final staging and construction methodology including plant and equipment needed for the proposal would be determined by the construction contractor and equipment timing and duration of activities may change, but this would be further assessed in a construction noise and vibration management plan prior to construction. Most works are anticipated to be conducted during standard hours, however there would be some activities required outside standard hours.

In summary:

- Up to 241 sensitive residential receivers may be impacted (exceed noise guidelines) for work carried out during standard hours, with predicted exceedances of up to 53 dB(A)
- Up to 50 sensitive residential receivers were modelled as potentially highly noise affected, with exceedances of up to 36 dB(A)
- Up to three sensitive non-residential receivers (two schools comprising 22 buildings and one church comprising three buildings) were also predicted to exceed their construction noise management level with predicted exceedances of up to 30 dBA.

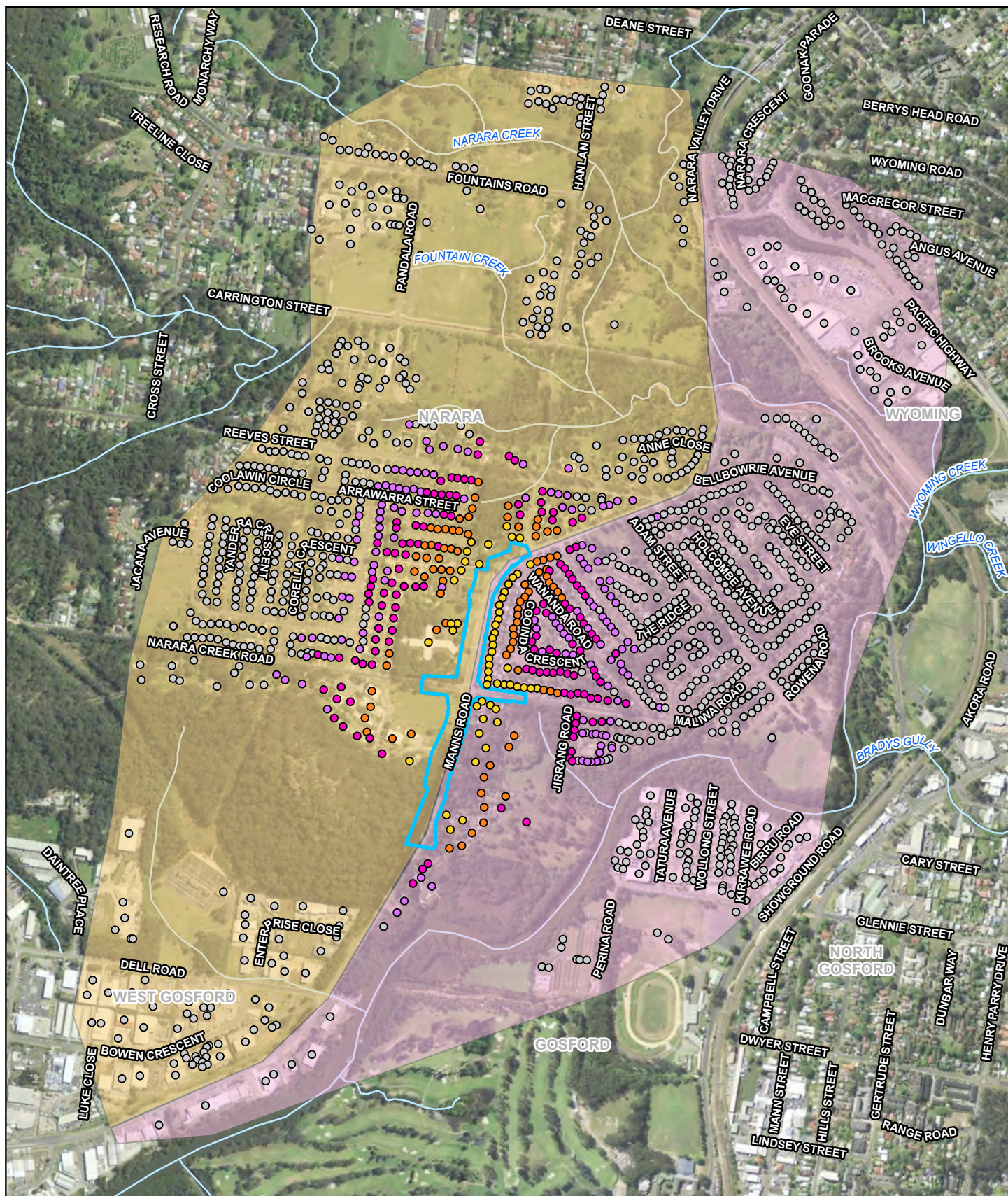
The number of exceedances for compound establishment and installing new full depth pavement are shown visually in Figure 6-2 and Figure 6-3.

Table 6-8: Number of exceedances - CNVG trigger level (standard hours)

NCA	Trigger level - Predicted airborne LAeq(15 min) noise level at receiver			Construction scenarios (defined under methodology section)												
	Perception	dBA above RBL	dBA above NML	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13
NCA1	Noticeable	5 to 10	0	37	33	48	63	48	43	43	48	9	6	8	1	29
	Clearly audible	10 to 20	< 10	45	38	45	60	45	42	42	45	2	0	1	1	26
	Moderately intrusive	20 to 30	10 to 20	24	24	37	38	37	30	30	37	0	0	0	0	17
	Highly intrusive	> 30	> 20	27	26	33	36	33	29	29	33	0	0	0	0	0
NCA2	Noticeable	5 to 10	< 5	52	34	64	70	64	57	57	64	38	34	40	2	29
	Clearly audible	10 to 20	5 to 15	39	43	54	70	54	40	40	54	32	17	22	2	15
	Moderately intrusive	20 to 30	15 to 25	32	18	35	44	35	34	34	35	3	3	3	0	6
	Highly intrusive	> 30	> 25	9	8	15	18	15	13	13	15	2	2	2	0	1

Table 6-9: Number of exceedances - CNVG trigger levels (OOHW night period)

NCA	Trigger level - Predicted airborne LAeq(15 min) noise level at receiver			Construction scenarios (defined under methodology section)												
	Perception	dBA above RBL	dBA above NML	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13
NCA1	Noticeable	5 to 10	0	66	61	39	53	39	57	57	39	71	54	61	1	49
	Clearly audible	10 to 20	< 10	130	120	153	131	153	139	139	153	104	71	79	3	173
	Moderately intrusive	20 to 30	10 to 20	63	51	84	105	84	70	70	84	5	2	4	1	49
	Highly intrusive	> 30	> 20	71	71	80	99	80	74	74	80	0	0	0	1	24
NCA2	Noticeable	5 to 10	< 5	50	46	62	100	62	47	47	62	20	36	31	1	23
	Clearly audible	10 to 20	5 to 15	58	54	89	93	89	72	72	89	60	28	36	1	27
	Moderately intrusive	20 to 30	15 to 25	30	13	35	44	35	28	28	35	2	2	2	0	4
	Highly intrusive	> 30	> 25	10	9	14	19	14	13	13	14	2	2	2	0	0



LEGEND

 Construction

 Noise catchment area 1

 Noise catchment area 2

Scenario S04 - Standard hours

 Receiver

 Highly intrusive (>20 dBA above NML)

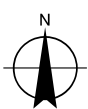
 Moderately intrusive (10-20 dBA above NML)

 Clearly audible (<10 dBA above NML)

 Noticeable (no exceedance of NML)

 Watercourse

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Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
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Manns Road Upgrade
Review of Environmental Factors
Narara Creek Road Intersection Upgrade

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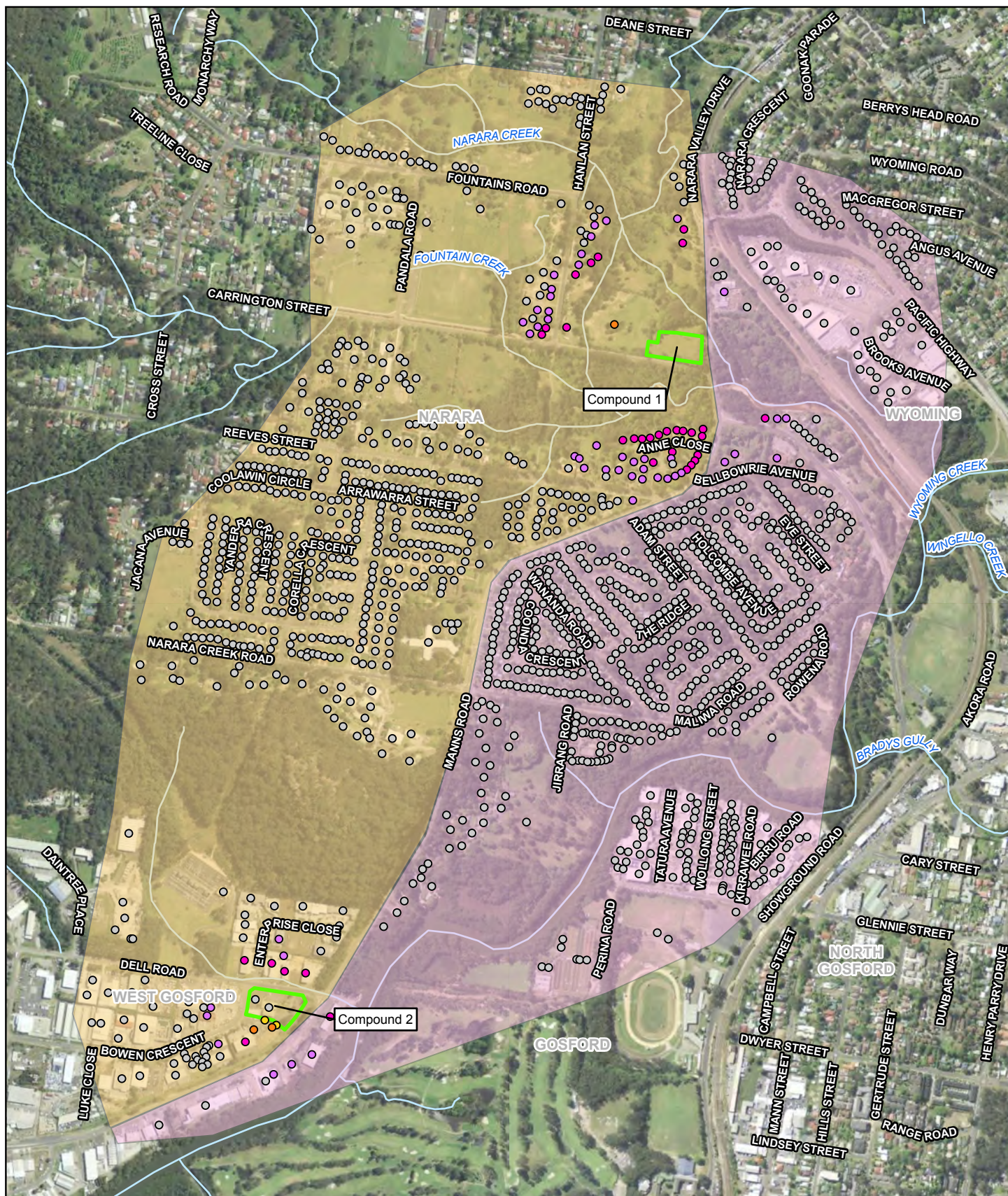
Construction noise impacts, pavement installation **Figure 6-2**

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Data source: LPI: DTDB / Aerial Imagery, 2017. Created by:tmorton



LEGEND

Compound

Noise catchment area 1

Noise catchment area 2

Scenario S09 - Standard hours

○ Receiver

○ Highly intrusive (>20 dBA above NML)

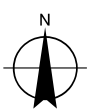
○ Moderately intrusive (10-20 dBA above NML)

● Clearly Audible (<10 dBA above NML)

● Noticeable (no exceedance of NML)

— Watercourse

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Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56



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Construction noise impacts, compound set up

Figure 6-3

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Data source: LPI: DTDB, 2017; RMS: Aerial Imagery, 2017. Created by:tmorton

Construction traffic noise impacts

The predicted increase in noise level due to construction traffic on the haulage routes has been calculated based on the total construction vehicle movements relative to the existing traffic volumes. The results from these calculations are shown in Table 6-10 and Table 6-11.

Noise increases due to construction traffic on the haulage routes is predicted to be less than 2 dB on all proposed roads. This impact is not expected to be significant or perceptible, above the existing noise environment, to most receivers and therefore specific mitigation measures for construction traffic noise would not be required for the proposal.

A traffic management plan would be prepared and implemented as part of the CEMP to manage haulage routes and movement of construction traffic throughout the proposal and minimise the impact of construction traffic noise on the community.

Table 6-10: Predicted increase in noise due to construction traffic - day time

Road	Existing traffic - light vehicles	Existing traffic - heavy vehicles	Peak construction generated traffic - light vehicles	Peak construction generated traffic - heavy vehicles	Predicted relative increase in total traffic noise (dB)
Manns Road-North of Narara Creek Road	16693	1244	115	70	0.1
Manns Road-South of Narara Creek Road	17857	1039	115	70	0.1

Table 6-11: Predicted increase in noise due to construction traffic - night time

Road	Existing traffic - light vehicles	Existing traffic - heavy vehicles	Peak construction generated traffic - light vehicles	Peak construction generated traffic - heavy vehicles	Predicted relative increase in total traffic noise (dB)
Manns Road-North of Narara Creek Road	2509	169	55	35	0.4
Manns Road-South of Narara Creek Road	2589	147	55	35	0.4

Construction vibration impacts

Predicted construction activities would result in some short-term increases in localised vibration levels, particularly for sensitive residential and sensitive non-residential receivers located close to the proposal site. The final staging and construction methodology for the proposal would be determined by the construction contractor and the equipment, timing and duration of activities may change, but this would be further assessed in a construction noise and vibration management plan prior to construction.

Vibration impacts focus on potential structural damage in close proximity to construction activities, with vibration levels falling as receiver distance from the source increases. Table 6-12 provides working buffer distances based on equipment likely to be used for the proposal, within which monitoring, alternative methods or extra controls for construction activities would be needed to reduce vibration to levels which comply with the human comfort, cosmetic damage, standard dwelling and heritage building structural damage criteria.

Table 6-12: Construction vibration buffer distances

Activity	Human comfort (1 mm/s)	Heritage building - potential structural damage (3 mm/s)	Standard dwelling – potential structural damage (5 mm/s)
Roller	90 metres	24 metres	13 metres
7 tonne compactor	140 metres	24 metres	13 metres
7 tonne compactor	120 metres	24 metres	13 metres
Pavement Breaker	90 metres	24 metres	13 metres
Dozer	90 metres	15 metres	8 metres
Backhoe	60 metres	3 metres	2 metres
Jackhammer	10 metres	2 metres	1 metre
Excavator	4 metres	7 metres	4 metres

Note 1: Guidance from BS 5228-2 has been used to provide an indication of potential human comfort impacts.

Note 2: Guidance from DIN 4150-3 has been used to provide an indication of structural damage impacts

With consideration to structural damage vibration impacts for general construction activities, the expected magnitude of ground vibrations should not be sufficient to cause damage if the equipment operates at distances greater than 13 metres from standard residential buildings or structures of similar construction. A figure highlighting the areas with potential for structural damage impacts for standard residential buildings is provided in the noise report in Appendix G (Volume 2). The noise and vibration mitigation measures detailed in Section 6.1.5 would be implemented to manage potential construction vibration impacts.

With consideration to human comfort vibration impacts, where rolling and compacting activities occur within 140 metres of adjacent receivers including residences, schools and places of worship, there is the potential vibration levels could be intrusive for some activities. It is possible local sensitive receivers may perceive construction vibration at times. The level of annoyance, however, would depend on individuals tolerance and activity at the time.

It is recommended where reasonable and feasible, buffer distances are implemented as per values shown in the corresponding activities. It is recommended the noise and vibration mitigation measures detailed in Section 6.1.5 be implemented to manage potential construction vibration impacts.

6.1.5 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction noise and vibration management	<p>A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in the Interim Construction Noise Guideline (DECC, 2009) and identify:</p> <ul style="list-style-type: none"> • All potential significant noise and vibration generating activities associated with the activity • Feasible and reasonable mitigation measures to be implemented, taking into account <i>Beyond the Pavement: urban design policy, process and principles</i> (Roads and Maritime, 2014) • A monitoring program to assess performance against relevant noise and vibration criteria • Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria. 	Construction contractor	Construction	<p>Core standard safeguard</p> <p>Section 4.6 of QA G36 <i>Environment Protection</i></p> <p><i>Interim Construction Noise Guideline</i> (DECC, 2009)</p> <p><i>Beyond the Pavement: urban design policy, process and principles</i> (Roads and Maritime, 2014)</p>
	<p>Include measures in the NVMP to shield sensitive receivers from noise, including:</p> <ul style="list-style-type: none"> • Placement and layout of construction compounds to locate primary noise sources away from sensitive receivers • Use solid structures (sheds, containers, etc.) as shields for sensitive receivers • Enclosure fixed noise sources such as pumps, compressors, fans, screens (where practicable). 	Construction contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	The NVMP would include additional noise mitigation measures to be implemented when exceedances of construction noise management levels remain after the implementation of standard noise mitigation measures, which will be implemented where reasonable and feasible. Guidance on suggested additional noise mitigation measures for each receiver are provided in the specialist noise report attached to this REF.	Construction contractor	Construction	Additional safeguard
	Include a complaints procedure in the NVMP to address complaints and corrective actions. This should include the requirement to undertake noise monitoring if applicable.	Construction contractor	Construction	Additional safeguard
	<p>All sensitive receivers (for example schools, local residents) likely to be affected will be notified at least five calendar days prior to the start of any work associated with the activity which may have an adverse noise or vibration impact. The notification will provide details of:</p> <ul style="list-style-type: none"> • The proposal • The construction period and construction hours • Contact information for project management staff • Complaint and incident reporting • How to obtain further information. 	Construction contractor	Construction	Core standard safeguard
	<p>An out-of-hours work procedure for assessing and managing activities requiring work outside of standard hours will be developed and would include the following:</p> <ul style="list-style-type: none"> • Five working days prior to the activity starting, contact the receivers from the local community which are potentially affected by the proposed work and inform them by letter of the proposed work, location, type of work, days and dates of work and hours involved • A 24-hour community liaison phone number and permanent site contact will be provided so complaints can be received and addressed in a timely manner • Measures to investigate and respond to any valid noise complaints. 	Construction contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction vibration impacts	Building condition surveys will be carried out at receivers (as required) within 50 metres of proposed vibration generating activities (buildings and other structures).	Construction contractor	Construction	Additional safeguard
	Where construction activities are scheduled to use vibration generating equipment, and there are occupied buildings within the relevant buffer distances specified in Table 5-27 of the Manns Road upgrade – Narara Creek Road Intersection Noise and Vibration Assessment, a notification to the affected properties would occur prior to the start of the construction activity.	Construction contractor	Construction	Additional safeguard
	Develop a monitoring plan in the NVMP that covers potential high vibration activities including work within 13 metres of sensitive receivers. The plan would include trial monitoring to determine actual vibration levels likely from the activity and a procedure for dealing with exceedances of the vibration criteria, which would include ceasing activities and investigation of alternative work methods	Construction contractor	Construction	Additional safeguard
Construction noise impacts - machinery	Where practical, construction equipment and machines will be selected to minimise noise emissions, fitted with appropriate silencers and be maintained in good working order.	Construction contractor	Construction	Additional safeguard
Operational noise impact	<p>An operational noise assessment would be undertaken during detailed design to further assess the need for reasonable and feasible noise mitigation measures for qualifying receivers outlined in the REF. The assessment would;</p> <ul style="list-style-type: none"> • Identify the types of noise treatment required at each receiver to reduce noise levels to the required criteria • Include facade testing for places of worship and educational premises to identify internal noise level reductions • Consider options for quieter pavement surfaces to reduce noise levels to the required criteria. 	Roads and Maritime	Detailed design	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Conduct post construction noise monitoring and assessment (including simultaneous counts) within 12 months of opening once traffic flows have stabilised. Monitoring locations should be at the same locations undertaken in this assessment and at locations where any noise complaints are received.	Roads and Maritime	Post-construction	Additional safeguard Section 6 of <i>Road and Maritime's Noise Model Validation Guideline</i>

6.2 Biodiversity

This section addresses the potential terrestrial and aquatic biodiversity impacts associated with the proposal and details the management measures proposed to mitigate these impacts. The information presented in this section is summarised from Chapters 4 to 8 of the Biodiversity Assessment Report prepared by GHD, which is provided in Appendix H (Volume 2).

6.2.1 Methodology

The Biodiversity Assessment was based on desktop review of available documents and field surveys conducted from 28 February to 2 March 2018. The assessment includes the following:

- Database searches and literature review
- Assessment of the likelihood of occurrence of threatened species in the proposal footprint
- Field survey – vegetation, targeted flora, opportunistic fauna and targeted fauna surveys
- Assessment of significance and associated impacts
- Recommendation of mitigation measures.

Database searches and literature review

Background searches pertaining to the proposal footprint and locality (within a 10 kilometre radius of the site, shown in Figure 6-4) were carried out to determine whether any threatened flora and fauna species, populations, ecological communities, migratory species and critical habitats as detailed in State and Commonwealth legislation occur or are likely to occur within the proposed work area. The database searches were conducted on 11 July 2018 for the proposal, and are summarised in Table 6-13, while the results of the database searches are provided in the likelihood of occurrence table in Appendix B of the Biodiversity Assessment (Appendix H (Volume 2) of this REF).

Table 6-13: Database searches

Resource	Target	Search Area
BioNet (website for the Atlas of NSW Wildlife and OEH BioBanking Threatened Species Profile Database)	Threatened flora and fauna species, populations and ecological communities listed under the BC Act	10 kilometre radius of the proposal footprint (study locality, Figure 6-4)
Department of the Environment and Energy (DoEE) Protected Matters Search Tool Act which may occur in the area (DoEE 2018a), DoEE online species profiles and threats database (DoEE 2018b)	Threatened flora and fauna species, populations and communities, and matters of national environmental significance listed under the EPBC Act	Study locality
Department of Primary Industries freshwater threatened species profiles and online database	Threatened freshwater fish and key fish habitat	Study locality
OEH and DoEE critical habitat registers (OEH 2018d, DoEE 2018c)	Critical habitat	Study locality

Resource	Target	Search Area
Department of Primary Industries NSW WeedWise – Priority weed declarations (DPI 2018c)	Priority weeds	Central Coast LGA

In addition to the database searches, literature and resources relevant to this assessment which were also reviewed including:

- Construction methodology and concept design
- Vegetation mapping completed by Bell (2013) for the Gosford Shire Council to identify native vegetation types occurring within the proposal footprint and the likely presence of any threatened ecological communities
- Reports for previous ecological studies completed within or close to the proposal footprint
- Biobanking Assessment Methodology and Credit Calculator Operation Manual
- Satellite imagery.

Likelihood of occurrence of threatened species

Following collation of database records, literature reviews and species and community profiles, a 'likelihood of occurrence' assessment was prepared with reference to the broad habitats contained within the area. The likelihood of threatened and migratory biota occurring in the proposal footprint was assessed based on presence of records from the locality, species distribution and habitat preferences, and quality of potential habitat present. The results of this assessment are provided in Appendix B of the Biodiversity Assessment Report (Appendix H (Volume 2) of this REF).

Field Survey

Field surveys of the proposal were conducted by three ecologists on 28 February to 2 March, 2018. The proposal footprint was surveyed as shown in Figure 6-4. Survey effort included flora and fauna survey methods as listed in Table 6-14.

Table 6-14: Biodiversity survey methods

Fauna survey methods	Flora survey methods
<ul style="list-style-type: none"> • Fauna habitat assessment • Bird surveys • Koala habitat assessment • Nocturnal call playback and spotlighting • General fauna surveys • Opportunistic threatened fauna observations 	<ul style="list-style-type: none"> • Random meander flora surveys • Plot/transects in accordance with the Biodiversity Assessment Methodology • Vegetation mapping • Opportunistic threatened flora observations • Random meander searches for threatened plants including <i>Melaleuca biconvexa</i> which is a known species in the wider area.

The objectives of the flora surveys were to:

- Determine all vegetation communities present within the proposal footprint, their condition and extent, with reference to the OEH plant community type (PCT) classification

- Identify potential Endangered Ecological Communities (EECs) within the proposal footprint and determine their condition and extent
- Identify whether threatened flora species are present within the proposal footprint, and whether it is likely any have the potential to occur within the habitats present
- Identify areas of high weed infestation.

Survey techniques and effort were conducted with reference to Department of Environment and Conservation (2004) survey guidelines and as appropriate to the habitats present and landscape context. Survey effort is shown in Figure 6-4. Further details on survey methodology and weather conditions during field surveys are provided in Section 4.3 of the Biodiversity Assessment Report (Appendix H (Volume 2)).

Assessments of significance

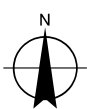
Assessments of significance were conducted for identified Threatened Ecological Communities (TEC), fauna and flora species with moderate or above likelihood to utilise habitat within the proposal footprint, or those were recorded during the site survey. These are included in Appendix B of the Biodiversity Assessment Report (Appendix H (Volume 2)).



LEGEND

- | | | |
|--------------------|-----------------------------|--------------------------|
| Proposal footprint | Concept design | Anabat |
| Survey locality | Random meander flora survey | Call playback |
| Watercourse | Flora transect | Fauna habitat assessment |
| | | Koala SPOT assessment |

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Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56



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Survey Effort

Figure 6-4

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Data source: LPI: DTDB, 2017, Aerial Imagery, 2015; OEH: Melaleuca biconvexa mapping, 2016. Created by: fmacKay, tmorton

6.2.2 Existing environment

The proposal is located along Manns Road in Gosford within the Central Coast Council LGA. Gosford lies to the north of Brisbane Water, and supports residential and recreational land uses. The proposal is located in the Sydney Basin Bioregion, on soils consistent with the Wyong Soil Landscape on poorly drained floodplains and alluvial flats, influenced by Narara Creek which is located 100 metres east of the proposal footprint.

Vegetation in the proposal footprint has been influenced by road infrastructure and residential development. Dense vegetation exists in the south of the proposal footprint, and is connected to larger tracts of vegetation to the west including Strickland State Forest.

Vegetation communities

The majority of the vegetation within the proposal footprint is disturbed due to historic clearing and urban and agricultural practices. Vegetation types identified within the proposal footprint are shown in Figure 6-5 and include:

- PCT 1579: Smooth-barked Apple – Turpentine – Blackbutt open forest on ranges of the Central Coast (0.88 hectares)
- PCT 1723: *Melaleuca biconvexa* - Swamp Mahogany - Cabbage Palm swamp forest of the Central Coast (0.11 hectares).

These vegetation types are also described in detail in Table 5-4 and Table 5-6 in Section 5.2 of the Biodiversity Assessment Report in Appendix H (Volume 2).

Other vegetation

Exotic vegetation was present alongside road infrastructure and in residential areas, comprising exotic grass species and environmental weeds. A total of 31 species of flora were recorded within the proposal footprint, comprising 18 native and 13 exotic. One threatened flora species was identified from biodiversity assessments for work in an area adjacent to the proposal footprint along the southern boundary of Compound 1 (SMEC, 2016), namely Biconvex Paperbark (*Melaleuca biconvexa*), within the PCT 1723 or *Swamp Sclerophyll Forest on coastal floodplains* EEC (Figure 6-5). This species is listed as vulnerable under the BC Act and EPBC Act, and although it exists in the proposal footprint for a potential ancillary facility site, it would be excluded from activities and does not need to be cleared as a result of the proposal. Impacts to this species are discussed in Section 6.2.3.

Likelihood of occurrence for other threatened species was assessed and found there was no suitable habitat for any other threatened flora species.

A species list was compiled and is included in the Biodiversity Assessment Report in Appendix H (Volume 2), along with a complete list of all threatened flora species recorded previously within the proposal footprint and an assessment of their likelihood of occurrence.

Priority and environmental weeds

One species declared as a priority weed in the Gosford local government area was identified within the proposal footprint. Lantana (*Lantana camara*) was identified in the dense vegetation in the southern portion of the proposal footprint. It occurs as dense thickets in the vegetation alongside Manns Road. Asparagus Weed (*Asparagus aethiopicus*) was also identified in the proposal footprint, north of the Narara Creek Road intersection opposite Wananda Road. Both species are considered to be weeds of national significance, which are regarded as the worst weeds in Australia because of their invasiveness, potential for spread, and economic and environmental impacts. Under the *Biosecurity Act 2015*, anyone who comes across weeds of national significance is required to 'prevent, eliminate and minimise' risk of spread.

There was also a number of exotic species present in the proposal footprint which are considered to be environmental weeds. Environmental weeds pose a threat to native biodiversity by competing and utilising valuable resources. It is important to prevent the spread of these weeds to protect native communities and reduce the need for future restoration activities. These include exotic invasive species like Paddy's Lucerne (*Sida rhombifolia*), Catsear (*Hypochaeris radicata*) and Flaxleaf Fleabane (*Conyza bonariensis*).

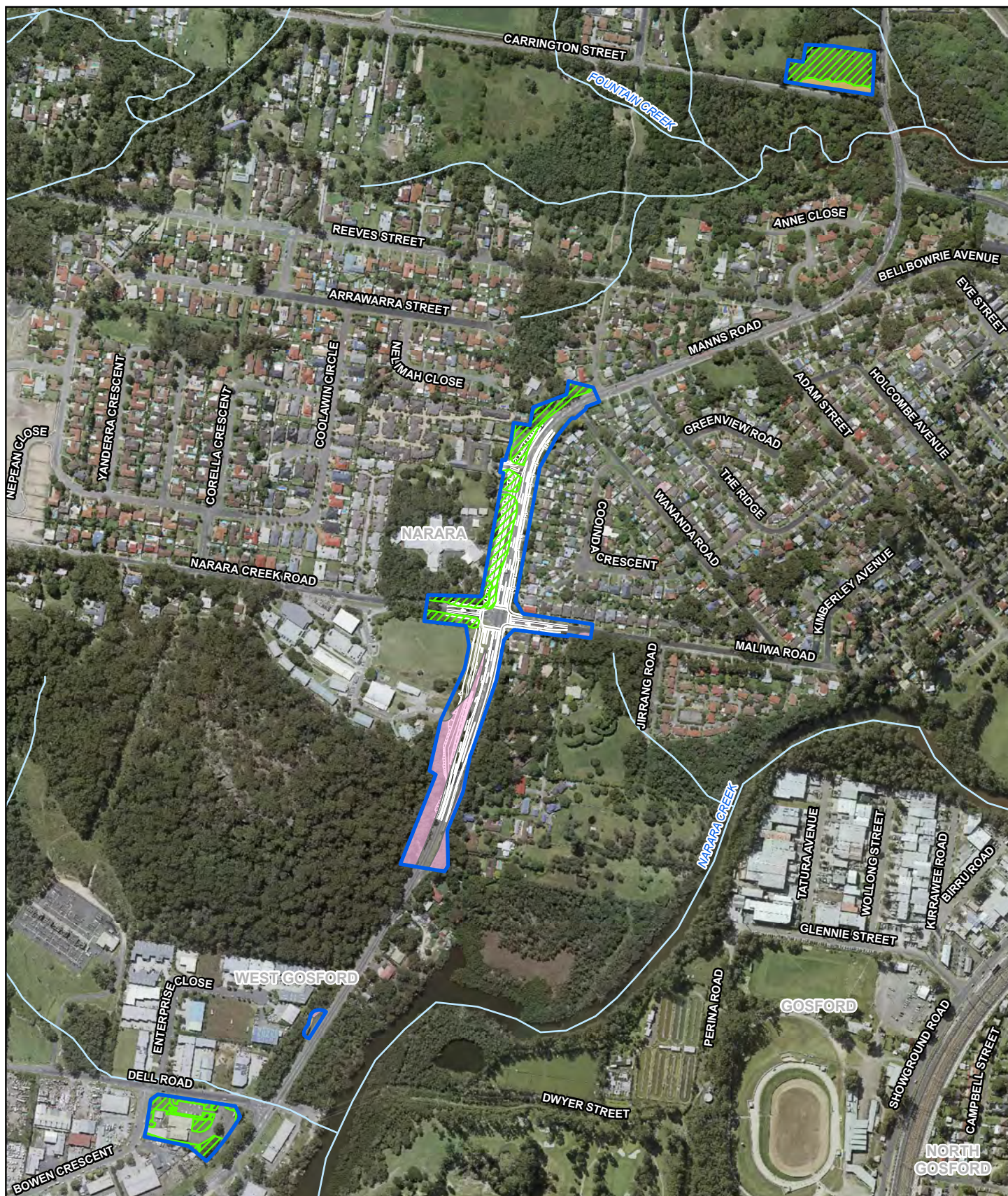
Mitigation measures to prevent the spread of these weeds are described in Section 6.2.4.

Threatened ecological communities

The desktop literature review identified 22 endangered ecological communities (EEC's) listed under the BC Act and 10 threatened ecological communities listed under the EPBC Act in the locality, as having been previously recorded or predicted to occur.

One threatened ecological community is present in the proposal footprint, namely the PCT 1723 *Melaleuca biconvexa* – Swamp Mahogany – Cabbage Palm swamp forest of the Central Coast, which is commensurate with *Swamp Sclerophyll Forest on coastal floodplains* listed as vulnerable under the BC Act. This EEC exists only as a strip along the southern boundary of the potential Compound site 1, where 0.11 hectares was identified (SMEC, 2016).

As discussed further in Section 6.2.3, this EEC would be excluded from any potential lease area available for use during compound operations and boundary controls would be implemented to prevent indirect and direct impacts during use. As such, no Assessment of Significance for this EEC has been prepared.



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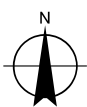
- Proposal footprint
- Concept design
- Watercourse

- Exotic grassland/scattered native and planted trees
- PCT 1579 - Smooth-barked Apple - Turpentine - Blackbutt open forest on ranges of the Central Coast

- PCT 1723 - *Melaleuca biconvexa* - Swamp Mahogany
- Cabbage Palm swamp forest of the Central Coast (EEC)

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56



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Vegetation map

Figure 6-5

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Data source: LPI: DTDB, 2017, Aerial Imagery, 2015; OEH: Melaleuca biconvexa mapping, 2016. Created by: fmacKay, tmorton

Threatened species and populations

Threatened flora species which are known or have the potential to occur in the proposal footprint are provided in Table 6-15.

Biconvex Paperbark (*Melaleuca biconvexa*) was recorded in Compound 1 as part of the PCT 1723 *Melaleuca biconvexa* - Swamp Mahogany - Cabbage Palm swamp forest of the Central Coast. This area of Biconvex Paperbark (*Melaleuca biconvexa*) along with the EEC, would be excluded from any potential lease area available for use during compound operations and boundary controls would be implemented to prevent indirect and direct impacts during construction. A likelihood of occurrence assessment identified no other threatened flora species are likely to occur within the proposal footprint.

Table 6-15: Summary of potential flora with a moderate or high potential of occurrence

Scientific name	Common name	BC Act status	EPBC Act status	Potential occurrence (Low, Moderate, High, Recorded)
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	Vulnerable	Vulnerable	Recorded

Two threatened fauna species were identified as having moderate likelihood of occurring in the proposal footprint based on background searches and habitat assessment, while one threatened fauna species was recorded during the field surveys, as listed in Table 6-16.

Table 6-16: Summary of potential fauna with a moderate or high potential of occurrence

Scientific name	Common name	BC Act status	EPBC Act status	Potential occurrence (Low, Moderate, High, Recorded)
<i>Mormopterus norfolkensis</i>	Eastern Freetail Bat	Vulnerable	Not listed	Moderate
<i>Miniopterus schreibersii</i>	Eastern Bentwing Bat	Vulnerable	Not listed	Moderate
<i>Miniopterus australis</i>	Little Bentwing Bat	Vulnerable	Not listed	Recorded

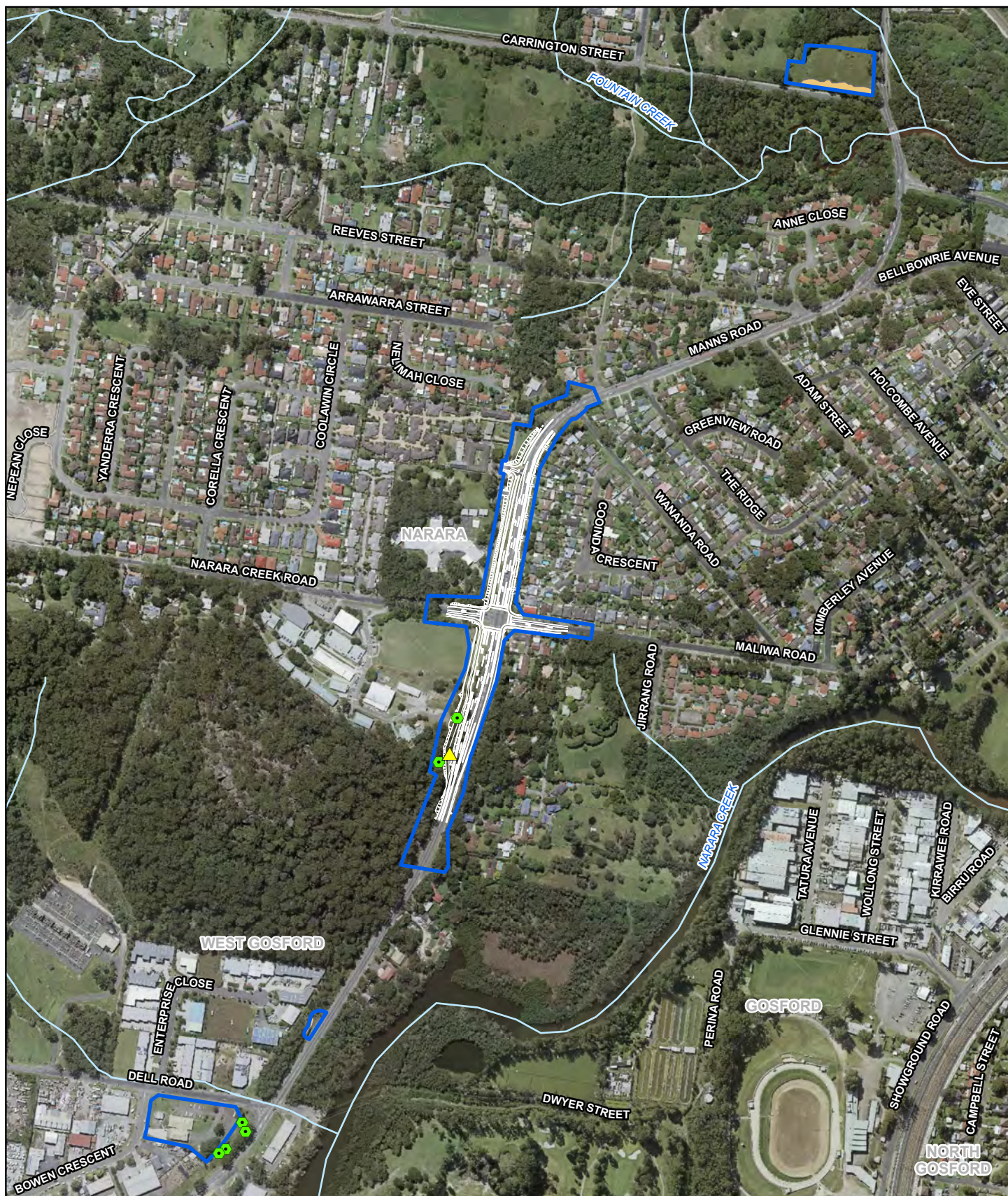
Fauna habitat

The main habitat types identified within the proposal footprint are described in Table 6-17. Threatened species recorded in these habitat types and habitat resources are shown in Figure 6-6. Species recorded during field survey are included in Appendix B of the Biodiversity Assessment Report (Appendix H (Volume 2)).

Table 6-17: Habitat types

Habitat type	Location	Habitat resources	Habitat condition	Fauna species recorded and/or likely to occur
Forested areas – swamp forest	Edge of Compound 1- near a tributary of Narara Creek and is associated with this drainage line	<ul style="list-style-type: none"> Canopy of Swamp Mahogany (<i>Eucalyptus robusta</i>) Midstorey of Biconvex Paperbark (<i>Melaleuca biconvexa</i>) High density of woody debris and leaf litter Overhang of tree roots 	Understorey is disturbed and due to this, the habitat is of moderate value	<p>Birds</p> <ul style="list-style-type: none"> Bell Miner Lewin's Honeyeater (<i>Meliphaga lewinii</i>) Yellow-faced Honeyeater (<i>Lichenostomus chrysops</i>) Rainbow Lorikeet (<i>Trichoglossus haematodus</i>) <p>Reptiles</p> <ul style="list-style-type: none"> Eastern Water Skinks (<i>Eulamprus quoyii</i>) Eastern Water Dragons (<i>Intellagama lesueurii</i>) Red-bellied Black Snake (<i>Pseudechis porphyriacus</i>).
Forested areas – dry sclerophyll forest	Revegetated embankment on the western side of Manns Road in the southern portion of the proposal footprint	<ul style="list-style-type: none"> Sparse midstorey of regenerating trees Sparse ground layer Leaf litter 	The regenerating vegetation on the roads edge is of poor value due to its lack of canopy and exposed position	<p>Birds</p> <ul style="list-style-type: none"> Australian Magpie (<i>Cracticus tibicen</i>), Australian Raven (<i>Corvus coronoides</i>), Noisy Miner (<i>Manorina melanocephala</i>) Common Myna (<i>Acridotheres tristis</i>)
	Within the south western boundary of the proposal footprint, to the west of the revegetated embankment alongside Manns Road	<ul style="list-style-type: none"> Mature canopy of 25 metres height Midstorey of small trees Shrub layer Dense groundcover Leaf litter Rock substrate Hollow-bearing trees (two within the proposal footprint) Eucalypt species containing nectar, sap, fruits and leaves 	Moderate value as this vegetation would experience edge effects such as light and noise from Manns Road	<p>Birds</p> <ul style="list-style-type: none"> Rainbow Lorikeet (<i>Trichoglossus haematodus</i>) Bell Miner (<i>Manorina melanophrys</i>) Eastern Yellow Robin (<i>Eopsaltria australis</i>) Red-browed Finch (<i>Neochmia temporalis</i>) Superb Fairy-wren (<i>Malurus cyaneus</i>) <p>Mammals</p> <ul style="list-style-type: none"> Little Bentwing Bat (<i>Miniopterus australis</i>) Eastern Bentwing Bat (<i>Miniopterus schreibersii oceanensis</i>) Common Ringtail Possum (<i>Pseudocheirus peregrinus</i>) Sugar Glider (<i>Petaurus breviceps</i>)

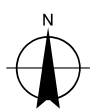
Habitat type	Location	Habitat resources	Habitat condition	Fauna species recorded and/or likely to occur
Maintained grassland and landscaped garden beds with scattered planted and native remnant trees	A narrow strip to the east and west of most of the Manns Road corridor and the intersecting local roads. It also occurs next to roads and amongst buildings.	<ul style="list-style-type: none"> • Mature trees • Landscaped garden beds 	Poor habitat for native fauna species, although it provides habitat for a range of common species typical of urban fragments and is therefore considered moderate value habitat	<p>Birds</p> <ul style="list-style-type: none"> • Australian Magpie (<i>Cracticus tibicen</i>) • Australian Raven (<i>Corvus coronoides</i>) • Noisy Miner (<i>Manorina melanocephala</i>) • Common Myna (<i>Acridotheres tristis</i>) • Galah (<i>Eolophus roseicapillus</i>) • Sulphur-crested Cockatoo (<i>Cacatua galerita</i>) <p>Mammals</p> <ul style="list-style-type: none"> • Long-nosed Bandicoot (<i>Perameles nasuta</i>) • Common Brushtail Possum (<i>Trichosurus vulpecula</i>) • Ringtail Possum (<i>Pseudocheirus peregrinus</i>)



LEGEND

- Proposal footprint
- Concept design
- Watercourse
- Hollow Bearing Tree
- ▲ Little Bentwing-bat
- Swamp Sclerophyll Forest
- EEC containing Biconvex Paperbark

Paper Size A4
0 25 50 100 150 200
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56



Roads and Maritime Services
Manns Road Upgrade
Review of Environmental Factors
Narara Creek Road Intersection Upgrade

Job Number 22-19033
Revision 1
Date 03/10/2018

Threatened biota and habitat resources

Figure 6-6

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Data source: LPI: DTDB, 2017, Aerial Imagery, 2015; OEH: Melaleuca biconvexa mapping, 2016. Created by: fmacKay, tmorton

6.2.3 Potential impacts

Construction

Construction phase impacts for biodiversity include:

- Removal of vegetation
- Removal of terrestrial fauna habitats
- Injury and mortality of fauna
- Sedimentation of nearby waterways
- Pollution
- Noise, light and vibration
- Wildlife connectivity and habitat fragmentation
- Weed invasion and edge effects.

These impacts are described in the following sections.

Removal of vegetation

Vegetation which would be impacted by the proposal is shown in Table 6-18.

Table 6-18: Direct impacts on vegetation

Vegetation	BC Act Status	EPBC Act Status	Amount in proposal footprint (ha)	Potential to be impacted by the proposal (ha)
PCT 1723 <i>Melaleuca biconvexa</i> - Swamp Mahogany - Cabbage Palm swamp forest of the Central Coast	Vulnerable	Not listed	0.11	0.0
PCT 1579 Smooth-barked Apple – Turpentine – Blackbutt open forest on ranges of the Central Coast	Not listed	Not listed	0.88	0.88
Exotic grassland with scattered native and planted remnant trees	Not listed	Not listed	1.55	1.55
Total			2.54	2.43

Mature native trees in the proposal footprint would be important for seed dispersal, although as there are large areas of this vegetation in the study locality extending to the west, and national parks and conservation reserves like Strickland National Park in the region, the removal of these trees would not place this community under threat, or significantly reduce seed source for the community. The majority of native vegetation which would be removed is located along the already disturbed edge of Manns Road, between Dell Road and Narara Creek Road where there is a low rate of recruitment and regeneration.

The PCT 1723 *Melaleuca biconvexa* - Swamp Mahogany - Cabbage Palm swamp forest of the Central Coast EEC is also habitat for the threatened flora species Biconvex Paperbark (*Melaleuca biconvexa*) which is listed as vulnerable under the BC Act and EPBC Act. The EEC and Biconvex Paperbark (*Melaleuca biconvexa*) habitat are only located in a part of the proposed Compound 1 site near the southern property boundary and not required to be disturbed for construction of the proposal. To avoid direct and indirect impacts on this vegetation, mitigation measures including a requirement for an exclusion zone around the EEC have been set out in Section 6.2.4.

Environmental safeguards to minimise the clearing of native vegetation, such as fencing of native vegetation outside the proposal footprint, as well as threatened ecological communities and threatened species in the proposal footprint would be included in the CEMP and would be carried out in accordance with the Roads and Maritime Service Biodiversity Guidelines (Roads and Traffic Authority, 2011) (Section 6.2.4).

Removal of terrestrial fauna habitats

Of the 67 (excluding marine species) threatened fauna species recorded within the study locality, one (Little Bentwing Bat, *Miniopterus australis*), was recorded during field surveys. The proposed work would result in a loss of 0.88 hectares of potential foraging habitat for this threatened microbat, and two others (Eastern Freetail Bat *Mormopterus norfolkensis*, Eastern Bentwing Bat *Miniopterus schreibersii*). Two hollow-bearing trees would also be impacted by the proposed work, which are small enough to potentially be used by microbats.

Assessments of significance for impacts to threatened microbats concluded the loss of about 0.88 hectares of potential foraging habitat is unlikely to cause a significant impact as only a small area of potential roosting habitat is present in the proposal footprint, and there is extensive areas adjacent to this habitat with similar habitat resources. The loss of two hollow bearing trees would reduce potential roosting habitat for these microbat species, although there is extensive areas of dry sclerophyll forest to the west of the proposal footprint, and more optimal vegetation including Strickland State Forest nearby the proposal which would contain similar habitat resources. Due to this, the removal of two hollow-bearing tree in the proposal footprint would not cause significant impacts to microbat species.

The proposal would also impact about 2.43 hectares of foraging habitat for woodland birds, reptiles and mammals. This 2.43 hectares includes about 1.55 hectares of non-optimal habitat containing predominantly exotic flora or disturbed, low condition vegetation.

It was found there would not be a significant impact to threatened species recorded in the proposal footprint or with the potential to occur with the implementation of mitigation measures as set out in Section 6.2.4.

Injury and mortality of fauna

There is potential for injury to or mortality of native fauna where native vegetation is to be cleared or disturbed.

Birds are relatively mobile so most individuals would be able to avoid vegetation clearing or construction operations. Most individuals which would be directly affected by construction of the proposal would be displaced initially. Continued survival of displaced fauna would depend on the carrying capacities of neighbouring remnants and the existing fauna present and their territories. There is extensive vegetation to the east and west of the proposal footprint that fauna are likely to disperse into during construction of the proposal.

There is a potential for the mortality of terrestrial animals less able to avoid the disturbance during clearing activities, including individuals sheltering in leaf litter, woody debris, crevices or under bark, such as small frogs and lizards. Smaller terrestrial mammals, nocturnal species and especially arboreal mammals, or birds which may be sheltering in tree hollows may also be subject to injury or mortality, particularly in the woodland and forest areas on the western side of Manns Road between Dell Road and Narara Creek Road.

Environmental safeguards including pre-clearing surveys, fauna rescue and relocation protocols are proposed in Section 6.2.4 to minimise the risk of mortality of fauna as a result of clearing.

Sedimentation of nearby waterways

The proposal has the potential to result in sedimentation and erosion within the proposal footprint and nearby vegetation through soil disturbance and construction activities.

While there are no drainage lines or waterways within the proposal footprint for direct impacts, sediment laden runoff to the stormwater network could occur during flood conditions and can result in altered water quality at downstream discharge points to waterways and drains outside the proposal footprint and indirectly affect aquatic life.

Appropriate safeguards and mitigation measures to prevent sedimentation entering into road drains are provided in Section 6.6.4.

Pollution

The proposal has the potential to result in pollution and contaminated runoff, in particular as a result of hydrocarbon leaks or spills from vehicles or equipment used in construction. The introduction of pollutants from the proposal into the surrounding environment if uncontrolled, could potentially impact on water quality and habitat values of nearby waterways.

Environmental safeguards to reduce the potential impacts associated with pollution are described in Section 6.2.4, and include appropriate location of stockpiles and bunding of chemicals, and the provision of sedimentation basins.

Noise, light and vibration

The proposal footprint currently experiences ongoing noise and vibration, primarily from heavy traffic flows along Manns Road. Construction of the proposal would increase noise levels and vibration near the proposal footprint temporarily during construction, through plant and machinery operation and activities such as earth moving, surfacing and retaining wall construction. Native fauna may temporarily vacate or avoid areas disturbed by construction activities.

Given the existing noise and vibration levels in the locality, the temporary increase in noise levels as a result of construction is unlikely to substantially change existing impacts from the current road operation on native fauna.

Wildlife connectivity and habitat fragmentation

Fragmentation of native vegetation and associated fauna habitats in the broader locality has previously occurred through clearing for the existing roads, agriculture, transmission lines and industrial areas. These land uses have created barriers to movement for some fauna species, particularly those which are limited by dispersal abilities and habitat preferences, although more mobile species such as birds and bats can readily traverse this landscape. Gaps in vegetation which deter the movement of animals have the potential to impact on genetic exchange and long-term viability of local populations. However, there are still some areas in the locality with intact vegetation such as the riparian vegetation corridor associated with Narara Creek and vegetation on the west of Manns Road between Dell Road and Narara Creek Road.

The proposal would involve widening of Manns Road, which already presents an existing barrier to wildlife connectivity, particularly where there is intact native vegetation to the south of the intersection. The existing gap in vegetation within the proposal footprint is approximately 25 metres. In the event all vegetation within the proposal footprint is cleared, this gap would be increased to about 60 metres in the widest area (southernmost extent). However, it is not anticipated vegetation on the east side of Manns Road would require clearing for the proposal as it is outside of the physical work, and clearing would be reduced as much as possible on the west side to minimise impact. In which case, it is likely the gap would be widened to about 35 metres. Connectivity between the east and west side of Manns Road would be maintained to the south of the proposal footprint, which would not be cleared as a result of this proposal. Future work may impact this area, but this would be investigated during future environment assessment, and mitigation measures to maintain connectivity would be considered at that time.

Fauna of particular concern for this proposal include terrestrial and arboreal fauna which may attempt to cross the road, such as bandicoots and possums, which have previously been recorded in the proposal footprint in the woodland area between Dell Road and Narara Creek Road. In addition, the proposal is likely to impact arboreal fauna which may attempt to glide across Manns Road, such as the common Sugar Glider (recorded south of the proposal footprint). An increase in the gap across Manns Road may lead to an increase in mortality of individuals which attempt to glide across the road and an associated loss of connectivity for wildlife. There is potential for an increase in the existing gap between vegetation on the east and west sides of Manns Road in the southern extent of the proposal footprint. Once the extent of increase has been confirmed during detailed design, mitigation measures for the connectivity of gliding species would be further investigated and developed where necessary.

Weed invasion and edge effects

Impacts of edge effects and weed invasion could occur as a result of the proposal, particularly at the interface with remnant native vegetation in the south of the proposal footprint next to Manns Road. However, native vegetation has already been either substantially modified due to urban development, or previously exposed to edge effects following construction and operation of the existing Manns Road. Exotic flora makes up the majority of the vegetation in the proposal footprint, including exotic grassland which is associated with residential and urban development. Priority weeds also exist in the proposal footprint amongst the woodland and forest areas on the west of Manns Road between Dell Road and Narara Creek Road.

Mitigation measures to prevent the invasion or spread of noxious and environmental weed species which could potentially impact native biota in the proposal footprint would be included in the proposal CEMP and should be addressed in accordance with the Roads and Maritime Service Biodiversity Guidelines (Roads and Maritime Services 2011).

Operation

Operation of the proposal is likely to have little impact on native biodiversity values. There may be some introduction of weeds as a result of movement of vehicles; however, this would not differ substantially from current levels of weed introduction from surrounding urban development, landscape maintenance and the existing Manns Road. Operation of the proposal would result in noise, lights and vibration along the route, but this would be similar to the levels currently experienced by fauna in the area from Manns Road. The risk of fauna mortality as a result of vehicle strike is unlikely to increase as a result of the proposal.

Connectivity for fauna would be impacted as a result of further widening of Manns Road, although this impact is not considered to be significant as the gap in native vegetation to the south of the proposal footprint would remain unchanged. However, once exact clearing has been confirmed during detailed design, the requirement for mitigation measures for wildlife connectivity would be reviewed.

Conclusion on significance of impacts

The proposal is not likely to significantly impact threatened species or ecological communities or their habitats, within the meaning of the *Biodiversity Conservation Act 2016* or *Fisheries Management Act 1994* and therefore a Species Impact Statement or Biodiversity Development Assessment Report is not required.

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

6.2.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Environmental management	<p>A Flora and Fauna Management Plan will be prepared in accordance with Roads and Maritime's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> (Roads and Traffic Authority, 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and trees and permanent and temporary revegetation areas Requirements set out in the <i>Landscape Guideline</i> (Roads and Traffic Authority, 2008) Pre-clearing survey requirements Procedures for unexpected threatened species finds and fauna handling Procedures addressing relevant matters specified in the <i>Policy and guidelines for fish habitat conservation and management</i> (DPI Fisheries, 2013) Protocols to manage weeds and pathogens. 	Construction Contractor	Construction	Core standard safeguard <i>Section 4.8 of QA G36 Environment Protection</i>
Habitat loss	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Detailed designer	Detailed design	Core standard safeguard
	The PCT 1723 <i>Melaleuca biconvexa</i> - Swamp Mahogany - Cabbage Palm swamp forest of the Central Coast in the proposal footprint at Compound site #1 should be excised from any lease or other land-use agreement and an exclusion zone implemented around the edge of the community with suitable barricades in accordance with <i>Guide 2: exclusion Zones, Biodiversity Guidelines</i> (Roads and Traffic Authority, 2011).	Construction Contractor	Construction	Additional safeguard <i>This safeguard only applies if Compound site #1 is selected for use by construction contractor</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Pre-clearance surveys	<p>A pre-clearance procedure will be developed in the Flora and Fauna Management Plan and implemented in accordance with the Roads and Maritime Biodiversity Guidelines.</p> <p>Pre-clearance surveys will be carried out by a qualified ecologist and the required methodology will be developed for target species as part of the as part of the Flora and Fauna Management Plan.</p> <p>Surveys would include:</p> <ul style="list-style-type: none"> • Inspection of any tree hollows for roosting fauna including microbats prior to removal • Recommendations for staged clearing in areas of native vegetation to allow any possible fauna present to migrate out of the construction zone • Marking of any habitat trees and features for specialist removal or removal under the supervision of the fauna specialist. <p>Fauna handling will be conducted in accordance with the Roads and Maritime Biodiversity Guidelines. Any unexpected threatened species finds will be managed in accordance with the Roads and Maritime Biodiversity Guidelines.</p>	Construction contractor	Construction	<p>Additional safeguard</p> <p>Roads and Maritime Biodiversity Guidelines (Guide 1: Pre-clearing process) (RTA 2011)</p> <p>Roads and Maritime Biodiversity Guidelines (Guide 9: Fauna handling) (RTA 2011)</p>
Worker inductions	<p>Ensure all workers are made aware of key flora and fauna management requirements, through a site environmental induction, prior to starting construction activities on site.</p> <p>This should include, but is not limited to, information on the ecological values of the site and details of protection measures to protect biodiversity during construction, including sensitive area and exclusion zone fencing and signage and procedures for dealing with injured fauna.</p>	Contractor	Construction	Additional safeguard
Weed removal and spread	<p>Protocols for preventing or minimising the spread of priority and environmental weeds will be developed and implemented in accordance with the Roads and Maritime Biodiversity Guidelines (Guide 6: Weed Management) (RTA 2011).</p>	Construction contractor	Construction	<p>Additional safeguard</p> <p>Roads and Maritime Biodiversity Guidelines (Guide 6: Weed Management) (RTA 2011).</p>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Weed invasion and edge effects	Ongoing weed management and control in accordance with the Roads and Maritime Biodiversity Guidelines (Roads and Traffic Authority, 2011).	Roads and Maritime	Operation	Additional safeguard <i>Roads and Maritime Biodiversity Guidelines</i> (Roads and Traffic Authority, 2011).
Connectivity and fauna habitat fragmentation	Once final design and construction areas have been confirmed for the southern parts of the proposal footprint, the need for mitigation measures for maintaining connectivity of gliding species across Manns Road would be further assessed and investigated during detailed design. This assessment would be documented in a design report. Connectivity measures will be implemented in accordance with the <i>Wildlife connectivity Guidelines for Road Projects</i> (RTA, 2011b).	Construction contractor	Construction	Additional safeguard <i>Wildlife connectivity Guidelines for Road Projects</i> (RTA, 2011b)
Vegetation rehabilitation	Native vegetation will be re-established following disturbance, where it does not obstruct road maintenance or affect road safety, in accordance with <i>Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011b). This includes undertaking restoration activities in areas of PCT 1579 Smooth-barked Apple – Turpentine – Blackbutt open forest, where disturbed by construction, using species of local provenance.	Construction contractor	Construction	Additional safeguard <i>Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011b).

Mitigation measures would be prepared with reference to Section 4.8 of QA G36 *Environment Protection*. Other safeguards and management measures which would address biodiversity impacts are identified in Sections 6.1, 6.4 and 6.10.

6.3 Socio-economic

A socio-economic impact assessment (SEIA) was prepared by GHD on behalf of Roads and Maritime for strategic Stage 5 work, which includes this proposal. The information relevant to the proposal presented in this section is summarised from Section 4.2 and Chapter 7 of the SEIA prepared by GHD, which is provided in Appendix E (Volume 2).

6.3.1 Methodology

The SEIA process was guided by the requirements of a moderate level assessment as per *Environmental Impact Assessment Practice Note - Socio-economic assessment* (Roads and Maritime Services, 2013). The process was also informed by social impact assessment principles and methods endorsed by the International Association for Impact Assessments (Vanclay, 2003 and Vanclay F, *et. al.*, 2015). Where applicable, principles from the Department of Planning and Environment (2016) *Social Impact Assessment – Draft Guidelines for State Significant mining, petroleum production and extractive industry development* were applied.

The following methodology was carried out to develop the SEIA:

- Review of background documents and other technical studies
- Determining the socio-economic area where direct and indirect impacts may occur as a result of the proposal
- Preparing a socio-economic baseline through a desktop review of relevant demographic and economic data to understand the existing conditions of the local and regional areas
- A site visit was conducted on 21 February 2018 to confirm the location of existing community infrastructure, observe land uses and traffic movements in the area
- Targeted consultation with stakeholders, including local community facilities, the Gosford Erina and Coastal Chamber of Commerce and emergency service providers
- Identification, description and assessment of impacts based on the findings of these tasks.

6.3.2 Existing environment

Overview

Narara is a low-density residential suburb to the north of West Gosford industrial area. The suburb is located between the Central Coast and Newcastle rail line to the east and bushland to the west. Manns Road runs along the eastern part of the suburb connecting to the Pacific Highway.

Largely undeveloped bushland separates the main residential area from the West Gosford industrial area. This area (between Dell Road and Narara Creek Road) is steep and heavily vegetated, with some residential properties on the eastern side with direct access onto Manns Road. Just beyond the bushland on Narara Creek Road are community infrastructure facilities of Glenvale School, St Philip's Christian College, C3 Church and Central Coast Emergency Accommodation Services for Women. To the east of these facilities is the local sporting ground of Gavenlock Oval on Maliwa Road.

There are existing high levels of traffic along Manns Road through the industrial area to the south. Manns Road is used by various road users passing through to other parts of the Central Coast, including commuters, deliveries, residents and visitors.

Demographic profile

In 2016, 7,934 people lived in the suburb of Narara. Narara's community is characterised by a relatively low median age of 38 compared to the Central Coast LGA, significantly higher proportion of family households, higher average household size and lower proportion of rented properties.

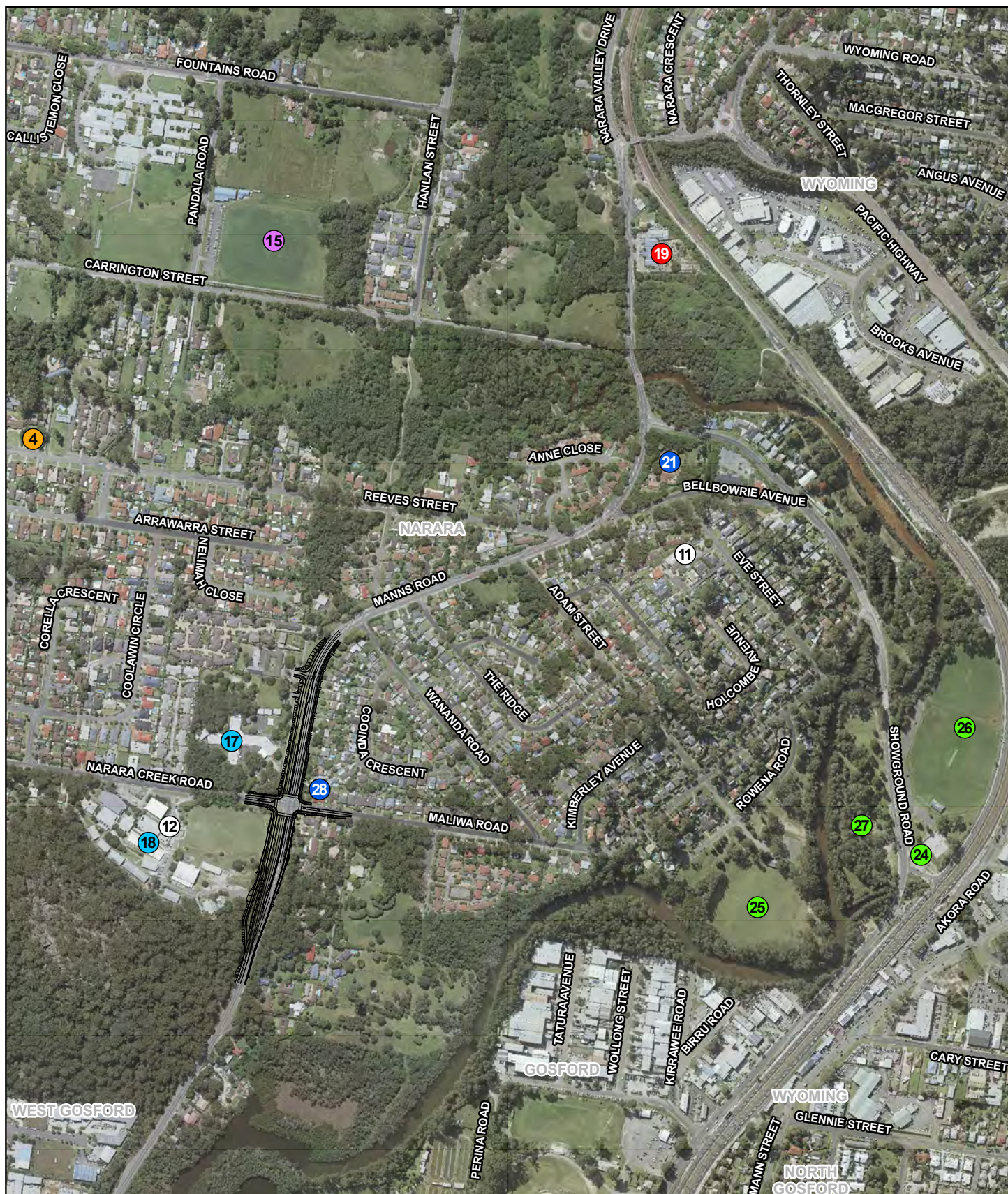
Community infrastructure

Community infrastructure facilities and services located within one kilometre of the proposal footprint include an aged care facility, childcare centre, a Christian pre-school, a fire brigade, mental health facility, women's shelter, neighbourhood centre, two schools, a skate park, two recreational ovals and a public garden.

The Narara suburb is serviced by emergency services which are beyond one kilometre of the proposal footprint. This includes Point Clare Ambulance Station (about eight kilometres away), Gosford Fire Station (five kilometres away), and Gosford Police Station. Gosford Public Hospital is the nearest hospital about four kilometres away from the proposal. Other community infrastructure within about one kilometre of the proposal includes child care facilities, health and support services and an aged care facility, as shown in Figure 6-7.

Businesses

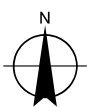
The Narara suburb is mostly residential. Within the Narara Creek Road Intersection Upgrade, there is one home business on the eastern side of Manns Road, which provides computer maintenance.



LEGEND

- Concept design
- Aged Care
- Child Care
- Community Centres and Spaces
- Education
- Emergency Services
- Health
- Open Space and Recreation

Paper Size A4
0 30 60 120 180 240
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56



Roads and Maritime Services
Manns Road Upgrade
Review of Environmental Factors
Narara Creek Road Intersection Upgrade

Job Number 22-19033
Revision 1
Date 03/10/2018

Community infrastructure

Figure 6-7

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Data source: LPI: DTDB, 2017; RMS: Aerial Imagery, 2017. Created by: fmacKay

6.3.3 Potential impacts

Construction

Increased traffic delays

Construction work would result in increased light and heavy construction vehicle traffic on Manns Road and the surrounding local road network, particularly to and from compounds. This may also result in increased heavy construction vehicles using local streets which usually cater to residential traffic. This may lead to temporary delays for road users, including:

- Motorists using Manns Road to travel to other areas
- Bus users
- Emergency services
- Residents near compounds at Manns Road and Carrington Street
- Users of local community facilities, including Glenvale School, St Philip's Christian College, C3 Church and Central Coast Emergency Accommodation Services for Women
- People travelling to community facilities to the north and south of the proposal.

Given the existing traffic volumes along Manns Road, this would be a temporary, negligible to low impact to these road users. This would be more noticeable to road users during local peak periods. Based on the traffic and transport report (Cardno, 2018), peak times occur between 8 am and 9 am, and 3 pm and 4 pm.

Mitigation measures for impacts to increased traffic delays are included in Section 6.3.4.

Changed access and connectivity

Key factors of the proposal which would impact local community facilities include the removal of a northbound bus stop on Manns Road and the addition of a median between north and southbound lanes on Manns Road. The removal of the bus stop would impact residents and visitors who use the existing bus stop who would be required to walk further to an alternative bus stop on Maliwa Road or further north on Manns Road. Pedestrian and cycling access is relatively low currently, and impacts to this mode of transport in the area would be negligible. Emergency access would not be impacted by construction of the proposal as access for emergency services will be provided at all times during construction.

Consultation with Glenvale School identified the primary mode of transport for students who attend the school is private vans and buses which utilise an access driveway on Narara Creek Road. Construction activities and increased construction traffic along the proposal footprint may result in temporary delays for access to and from the school although the project would be required to maintain a safe alternative access at all times during operating hours.

Some driveways would require alteration as part of the road widening, with associated temporary restricted access to affected properties, which may affect the usual access of residents. Pedestrian access along Manns Road would also be impacted at times. Further detail on how the altered access would impact key community facilities is provided in Section 7.1.1 of the attached SEIA report. Safeguards and management measures for changed access and connectivity during construction are provided in Section 6.3.4.

Property impacts

As discussed in Section 6.5, the proposal would require a temporary construction access agreement for a strip of land at St Philip's Christian College, Glenvale School and some residential properties along the proposal footprint to accommodate construction work. This may involve temporary impact on existing features within the properties (for example some private open space, signage, fencing).

The proposal would also require the lease of privately owned property to accommodate construction Compound 1 in the north of the proposal. Compound 1 currently comprises vacant grassed land within a larger privately owned block. While a potential future lease of part of the property for a construction compound would only affect the vacant areas of the site, this may temporarily reduce the overall private open space. Construction activities within Compound 1 would cause some impacts to amenity of residential properties as discussed in Section 6.1 and Section 6.10.

Compound 2 is a functional heavy vehicle inspection centre which is owned by Roads and Maritime. Property impacts for construction Compound 2 would be resolved through the implementation of a use agreement.

Safeguards and management measures for property impacts are discussed in Section 6.3.4.

Parking

Informal parking on the verges of Manns Road within the proposal footprint would be unavailable during construction. Parking on verges is informal and uncontrolled and largely periodic for visitors to schools, community facilities and churches, and will mostly affect some local road users such as adjacent residents and staff/students/visitors of the schools or churches.

The loss of informal on-road parking within the proposal would be minimal and on-street parking will still be available on side streets outside the immediate proposal footprint further east on Maliwa Road and on Wananda Road. Pedestrian crossings and access through the proposal would also be maintained which will support some alternative options for short-term parking outside the proposal footprint.

If construction vehicles park along local roads this would reduce the parking available for local residents and staff/visitors at schools and other community facilities.

Safeguards and management measures for impacts to parking during construction of the proposal are discussed in Section 6.8.4.

Local amenity

Noise and vibration as a result of construction activities may affect the amenity of properties near to the work, including Glenvale School, St Philip's Christian College, C3 Church and Central Coast Emergency Accommodation Services for Women and residential dwellings. Sensitive receivers near the compound areas have the potential to experience impacts to amenity including residents, Central Coast Association of Relatives and Friends of the Mentally Ill and Kingdom Hall of Jehovah's Witnesses. Glenvale School may also experience potential amenity impacts as students with special needs may become stressed or anxious due to increased noise.

There is potential for work to be carried out outside of standard construction hours which would also cause potential light spill and noise from construction. Any noise impacts from out of hours work would be temporary, although any noise could potentially cause loss of sleep for residents. Noise and vibration impacts, as well as safeguards and management measures are discussed in Section 6.1.

Visual amenity could also be reduced in the proposal footprint during construction due to machinery and plant. Impacts to visual amenity, and safeguards and management measures for these impacts are discussed in more detail in Section 6.4.

Further detail on potential amenity impacts to key community facilities is provided in Section 7.4.1 of the attached SEIA. Safeguards and management measures for impacts to local amenity are discussed in Section 6.3.4.

Community values

The construction of the proposal has the potential to alter the community's perception of the amenity, safety and accessibility of Manns Road. This could discourage some community members, including residents, cyclists, commuters and visitors, from using Manns Road to visit usual facilities, services and social networks around the proposal footprint. Perceived changes to the community's access may in turn change people's lifestyle and level of community participation. This impact would be reduced with the implementation of safeguards and management measures provided in Section 6.3.4.

There are adjacent community facilities which provide services to vulnerable groups that may be impacted by construction, including students with complex disability needs at the schools, and users seeking emergency accommodation services at the Central Coast Emergency Accommodation Services for Women. Vulnerable community members in particular may be more dependent on accessing these facilities. The proposal may also change the community's perception of road safety of children around the two schools. Maintaining access and ongoing consultation would be important throughout the construction, particularly for these groups, as described in Section 6.3.4.

Economy

The proposal is expected to create construction jobs which would be available for local and regional residents. The construction workforce would result in increased expenditure in local goods and services, such as food and beverage services. The proposal is also expected to increase the demand of goods for construction, such as construction materials. This would be temporary, however would still be of benefit to the local and regional economy.

Operation

Improved traffic flow and safety

The proposal would increase the capacity of Manns Road and Narara Creek Road / Maliwa Road at the intersection. This would reduce traffic delays for users of Manns Road, providing a positive impact.

The central median would improve traffic flow and road safety by decreasing the number of vehicles turning across oncoming traffic into properties. Improved traffic flow would provide a benefit to users of nearby community facilities, particularly Glenvale School and St Philip's Christian College. Further, the reduction of the crest with associated increase in line of sight and the widening of the intersection would improve road safety. Improved traffic flow and safety is discussed in more detail in Section 6.8.

The proposal would provide a long term, positive benefit for cyclists and pedestrians. The provision of improved pedestrian and cyclist facilities would provide safety benefits to pedestrians and cyclists given existing facilities are limited along the section. These improvements, particularly in safety, would benefit adjacent community facilities, including students who walk and cycle to St Philip's Christian College and users of Central Coast Emergency Accommodation Services for Women and C3 Church.

The proposal does not include a fence on the central median and as such, this would not impact access for emergency services.

Altered access to left in/left out only

The construction of a section of central median necessary for safety at the improved traffic lights, would restrict right turn access to/from some residential properties along part of Manns Road and the C3 Church. This may require residents to take alternate routes of up to 700 metres or one minute travel. Providing a raised median would improve safety in the long-term, and would not cause major diversions or complete loss of access. Alternative options include turning into streets off Manns Road to turn around, including Narara Creek Road and Maliwa Road. Full access to Glenvale School and St Philip's Christian College would remain available from the traffic lights at Narara Creek Road.

This would be a long-term, negligible impact on a small proportion of residents in the area and visitors to C3 Church. Further engagement and consultation is proposed for the altered access, as described in Section 6.3.4.

Public transport access

Three bus stops are located within the proposal footprint including two on each side of Maliwa Road and one on the west of Manns Road outside Glenvale School. The proposal would involve the removal of the northbound bus bay outside Glenvale School. While the proportion of bus users in the Central Coast LGA is relatively small (1.3% of residents), the loss of this bus stop has the potential to reduce the access of some bus users, who currently use this stop to take a bus heading north. Consultation with Glenvale School and St Philip's Christian College did not raise any issues, as public buses were not identified as a key mode of transport for students.

The proposed removal of the bus stop would require bus users to walk 190 metres or two minutes and cross Manns Road to access another bus stop on Maliwa Road to head north. There are existing pedestrian signals to cross Manns Road to allow for a reliable safe crossing and the enhanced footpaths would provide a more connected system and the existing bus stops within the proposal would be upgraded. Therefore, the removal of the bus stop would be a negligible impact to users. Alternatively, existing bus stops on Manns Road about 370 metres to the north of the proposal would be retained which also service the same route (northbound). Further engagement and consultation is proposed for the bus stop, as described in Section 6.3.4.

Property impacts

Road widening would require the partial strip acquisition of land around two residential properties, an area of open space within the Glenvale School and an area of land beside the school oval at St Philip's Christian College, which may result in the permanent loss of some informal private open space. This is not expected to impact any buildings on school property or reduce the functional areas of the school oval within St Philip's Christian College (refer to Section 6.5).

Minor driveway adjustments would be required for a majority of the properties along the east of Manns Road adjacent to the proposal (Section 3). All existing accesses would be reinstated to suit the new road formation. As such, any changes to access would be a negligible impact. Mitigation measures for property and land use impacts are addressed in Section 6.5.

Parking

Informal parking on the verges of Manns Road within the proposal footprint would be permanently removed during operation. Existing parking on verges is informal, uncontrolled and in places potentially unsafe for pedestrians, road users and local residents. However, the loss of informal parking spaces may still affect some road users such as local residents, school staff and visitors. The provision of a footpath would improve access and safety for pedestrians, including school students, staff, visitors to neighbouring community facilities and local residents, as vehicles would no longer be able to park within pedestrian areas. On street parking along local roads will remain as existing, but would be enhanced by improved footpath connections, providing an alternative for visitors.

Given the overall community benefit through the removal of informal parking along verges to accommodate new connected pedestrian facilities, this would be a negligible impact.

6.3.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
General construction impacts	<p>A Communication Plan will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The Communication Plan will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008) and include (as a minimum):</p> <ul style="list-style-type: none"> • Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions • Contact name and number for enquiries and complaints. <p>The Communication Plan will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008).</p>	Construction Contractor	Construction	<p>Standard core safeguard</p> <p><i>Community Involvement and Communications Resource Manual</i> (RTA, 2008)</p>
	<p>Additional aspects to be considered in the Communication Plan would comprise:</p> <ul style="list-style-type: none"> • Communication with the community with timely and relevant information to enable them to understand the likely nature, extent and duration of vibration, dust, noise and utility impacts and access changes • Targeted communication strategies will be prepared and implemented for key stakeholders to discuss potential noise impacts during construction and operation, potential privacy concerns and availability of safe pedestrian and vehicle access. Specific stakeholders to be covered include: <ul style="list-style-type: none"> – General community and local residents – Glenvale School – St Philip's Christian College – Central Coast Emergency Accommodation Services for Women 	Construction Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> – Local sporting clubs at Gavenlock Oval – Local health/support services – Vulnerable (for example older people, people with a disability) households – Related assisted transport providers. • Communication will include roadside signage, letterbox dropped newsletters, newspaper advertisements, construction hoarding or project signs including contact details, Roads and Maritime web based information and project enquiries line. 			
Traffic delays	A detailed traffic management plan would be prepared. The plan would provide details of the traffic management to be implemented during construction to ensure traffic flow on the surrounding network is maintained where possible. Consultation with Council would be conducted during preparation of the traffic management plan.	Construction contractor	Pre-construction and construction	Additional safeguard
Altered access	Construct suitable temporary alternative accesses (either via diversion or altered access provisions) during construction and reinstate driveways for properties impacted by the design.	Construction Contractor	Construction	Additional safeguard
	Provide safe alternative pedestrian access to designated crossing points on Manns Road and all community facilities, schools and local properties at all times during construction. Supply signage for pedestrians to road crossings, schools and properties as required.	Construction Contractor	Construction	Additional safeguard
Altered access to left in/ left out only	Engage with the C3 Church and residents affected by the left-in, left-out only as a result of the central median and discuss alternative routes and access.	Roads and Maritime	Detailed design	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Property impacts	<p>Carry out targeted consultation with property owners regarding potential strip acquisition and use of the privately owned site for Compound 1.</p> <p>Existing features impacted by the temporary occupation would be reinstated or replaced if damaged following agreement with the property owner.</p>	Roads and Maritime	Detailed design	Additional safeguard
Parking impacts	<p>Construction personnel/vehicle parking would be provided in construction compounds.</p> <p>All construction personnel will be informed that parking should be within the compounds or work sites, and to avoid parking on local roads.</p>	Construction contractor	Construction	Additional safeguard
Public transport	Engage with Glenvale School, St Philip's Christian College and the bus provider during detailed design regarding the potential removal of the bus stop on Manns Road to understand the use and ensure that alternative routes can be maintained in the short and long term. The complex needs of students who attend students from Glenvale School would be considered.	Roads and Maritime	Detailed design	Additional safeguard
	Provide advance warning of the potential removal of the bus stop and advertise alternative routes to the nearby stops during and following construction.	Roads and Maritime	Pre-construction	Additional safeguard

6.4 Landscape character and visual impacts

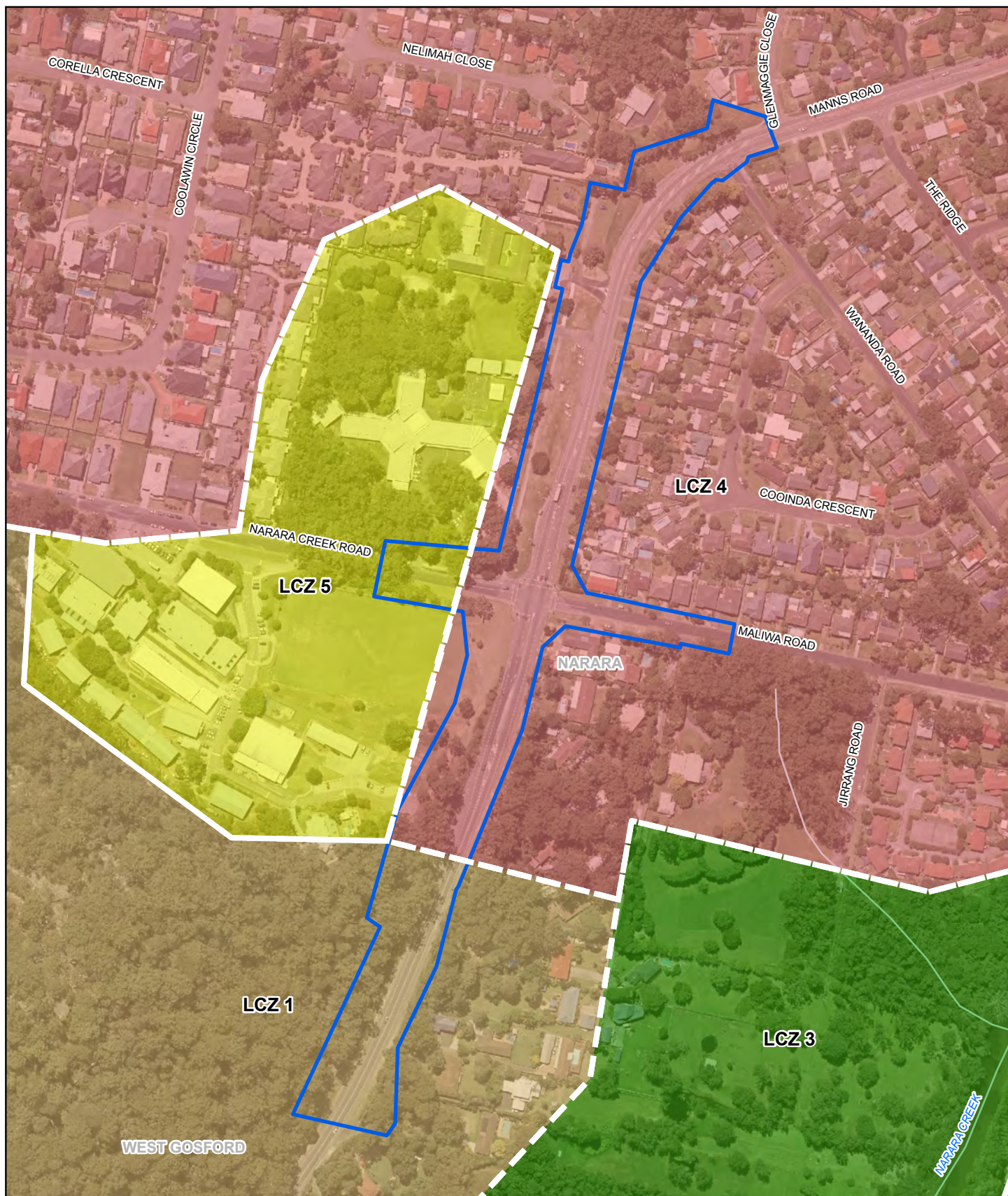
6.4.1 Methodology

A landscape character and visual impact assessment for the broader Stage 5 upgrade was prepared by Peter Andrews and Associates (2018). The assessment was prepared in accordance with the Roads and Maritime *EIA-N04 Environmental Impact Assessment Practice Note – Landscape Character and Visual Impact Assessment*. This assessment covered the proposal area and relevant information has been extracted from this document and included in the assessment in the following sections.

6.4.2 Existing environment

The proposal footprint and immediate surrounds is characterised by enclosed woodland, schools, low density residential dwellings and Narara Creek to the east (Figure 6-8), with the following features:

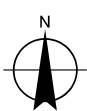
- **Enclosed woodland areas:** Comprised of steep slopes generally falling east towards Narara Creek with generally dense mature, semi-mature and regrowth native trees (mostly Eucalyptus species), dense mid-level native and exotic shrubs with generally native grass species understory. This area is heavily vegetated with cleared 'avenues' for overhead power lines, road network and development.
- **Low density residential:** A low density residential area located north east of the proposal with mostly one and two storey single family dwellings. North of Narara Creek/Maliwa Roads is characterised by informal planting with a mix of native and exotic tree species in turfed verge areas with occasional larger tree species tending to be located within private property boundaries. Exotic species are occasionally used for privacy hedge planting along property boundaries. South of Narara Creek/Maliwa Roads includes predominantly native tree species with mid-storey native and exotic planting along boundaries providing screening to properties. Typical landscape treatments within private yards of dwellings comprise turfed verges with some street planting.
- **Schools / institutional:** St Philip's Christian College and Glenvale School are located west of the proposal on Narara Creek Road. Landscape features include large open lawn areas next to the schools with some landscape retaining walls at St Philip's Christian College. Dense tree planting, fences and turf verges generally define the property boundaries at Glenvale School, while turf and trees are planted in verge areas to both sides of Narara Creek and Maliwa Roads. There are open, turfed playing fields visible from Manns Road with minimal tree planting at St Philip's Christian College. Stands of semi-mature, dense native and exotic tree planting to Glenvale Street frontages limit visibility to the school from Manns Road.
- **Narara Creek and recreation areas:** Narara Creek is to the southeast of the proposal with predominantly native trees and vegetation at varying stages of growth including continuous, dense tree canopy in the upper and middle stories and regrowth saplings, grasses and exotic weeds comprising the understory. The creek is heavily vegetated with informal cleared areas for river access and is zoned for recreational use with formal and informal recreational areas.



LEGEND

- ▬ Proposal footprint
- ▬ Watercourse
- ▬ Enclosed woodland
- ▬ Schools / institutional
- ▬ Low density residential
- ▬ Narara Creek and recreation areas

Paper Size A4
0 25 50 75 100
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Roads and Maritime Services
Manns Road Upgrade
Review of Environmental Factors
Narara Creek Road Intersection Upgrade

Job Number 22-19033
Revision 1
Date 03/10/2018

Landscape character zones

Figure 6-8

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Data source: LPI: DTDB / DCDB, 2017. PAA: Landscape character zones, 2018. Created by:tmorton

6.4.3 Potential impacts

Construction

During construction, positioning of plant and equipment within the view of neighbouring properties and existing road users would result in temporary minor visual impacts. Earthwork would also expose subsoil. The use of lighting towers during any night work may result in light spill impacting adjoining properties and residents.

The proposal would require removal of some vegetation within the boundaries of the proposal footprint including exotic grassland and native remnant and planted trees, and 0.88 hectares of PCT 1579 Smooth-barked Apple – Turpentine – Blackbutt open forest on ranges of the Central Coast. Some of this vegetation contributes to the amenity and character of the local area. This would lead to temporary visual impact during construction until the works are complete and disturbed areas rehabilitated.

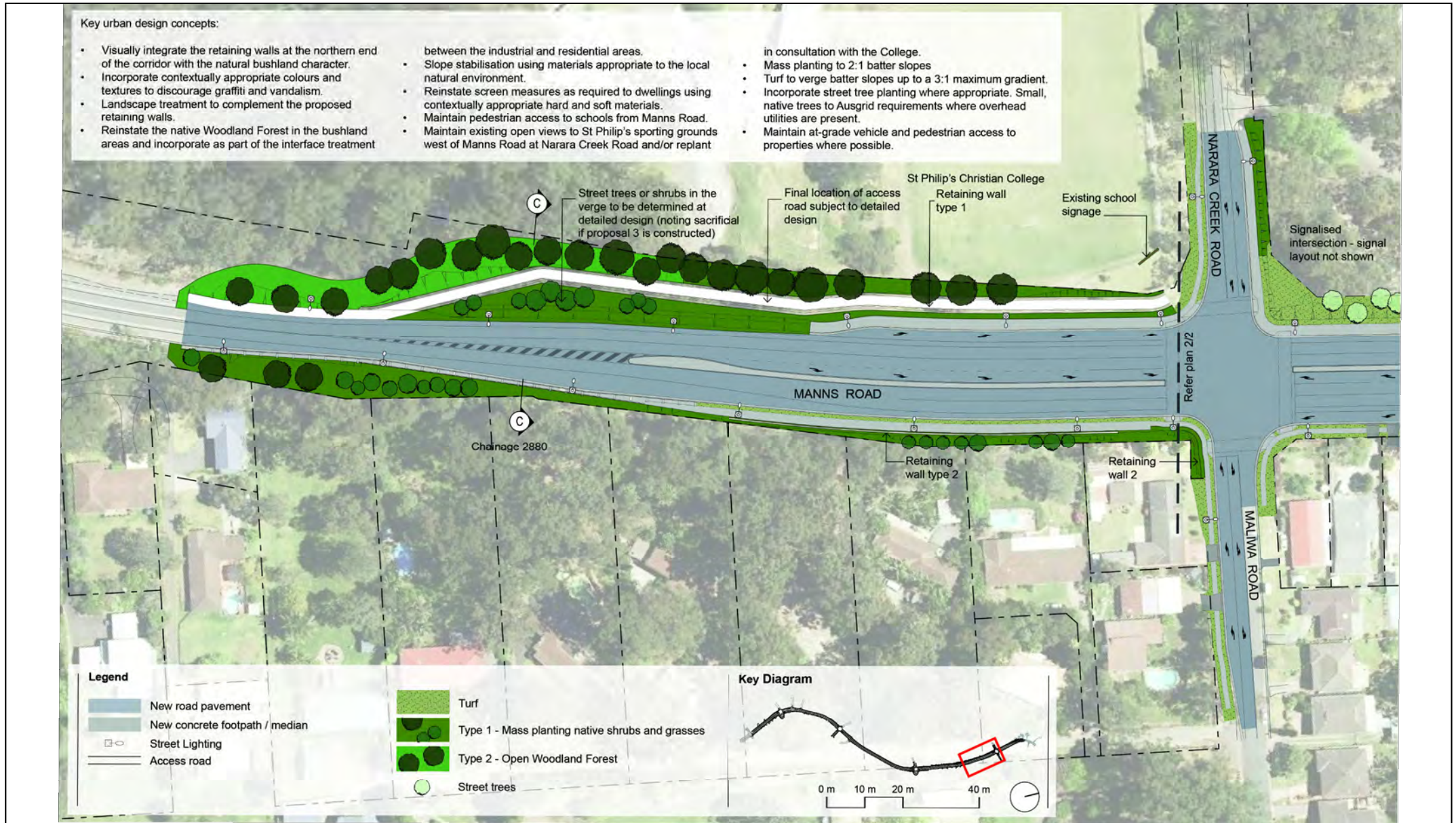
Potential visual impact during construction would be minimised through implementation of the safeguards and management measures outlined in Section 6.4.4.

Operation

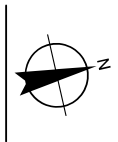
Landscape character

The impact to landscape character is considered to be moderate to low for the low density residential and schools / institutions as the existing suburban character would remain, but some turfed verges with street planting may be removed from outside residential properties on the east and from the schools on the west of Manns Road, which would be replaced by the widened road. The impact to the enclosed woodland zone is considered to be moderate due to the vegetation removal along the northbound lanes just south of the intersection and the addition of a tall retaining wall, although the landscape character would generally retain its vegetated enclosed character.

The impact of the proposal would be minimised with the implementation of an Urban Design Plan, which would provide an improved and consistent landscape character resulting in a positive visual and amenity impact compared with existing conditions. The positive change in landscape resulting from the proposal would mainly affect owners and residents of properties near the proposal footprint, and future road users. A concept of the proposed landscaping in the proposal footprint during operation is provided in Figure 6-9.



Paper Size A4



LEGEND



Roads and Maritime Services
Manns Road Upgrade
Review of Environmental Factors
Narara Creek Road Intersection Upgrade

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Revision 1
Date 01/05/2019

Urban concept design

Figure 6-9a

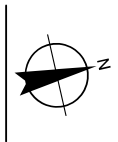
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Data source: Peter Andrews Assoc: Urban design strategy, 2018. Created by: tmorton



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LEGEND



Roads and Maritime Services
Manns Road Upgrade
Review of Environmental Factors
Narara Creek Road Intersection Upgrade

Job Number 22-19033
Revision 1
Date 01/05/2019

Urban concept design

Figure 6-9b

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Data source: Peter Andrews Assoc: Urban design strategy, 2018. Created by: tmorton

Retaining walls



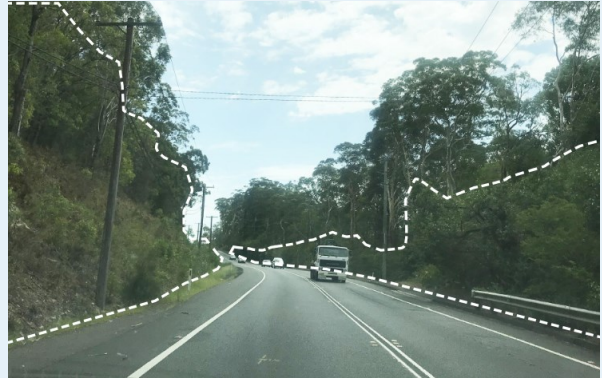
Two key retaining walls are required in the verge areas on Manns Road south of the Narara Creek/Maliwa Road intersection. A higher type 1 retaining wall is proposed on the western side of Manns Road and a lower type 2 retaining wall is proposed on the eastern side of Manns Road (refer Figure 6-9 for wall locations). Both retaining walls would face onto Manns Road and provides an opportunity to incorporate an appropriate urban design treatment to visually improve this section of the road corridor. The type 1 retaining wall incorporates a near-vertical rock-bolted wall system. A type 2 wall incorporates a reinforced, core-filled block retaining wall with a textured and coloured face to a maximum of 2.4 m in height.

Treatments for this wall would be finalised in the Urban Design Plan prepared during detailed design.

Visual impact

The visual impact of the proposal was assessed from three view points within the proposal footprint, with the visual impact from each assessed as moderate-low to high-moderate, as described in Table 6-19. Mitigation measures provided in Section 6.4.4 would minimise this impact.

Table 6-19: Visual impact

Aspect	Viewpoint 1	Viewpoint 2	Viewpoint 3
Viewpoint	Looking south towards the intersection from the northern-most extent of work.	Looking south along Manns Road from the Narara Creek Road intersection	Looking north along Manns Road towards Narara Creek Road intersection
Photograph			
Sensitivity of view	Low sensitivity due to the closeness of dwellings and school grounds to the road corridor. Views are generally limited by existing vegetation, fences and/or tree canopy.	Moderate sensitivity of view as the area is vegetated, but views are generally limited from existing dwellings by vegetation, fences and/or tree canopy.	There would be a moderate sensitivity to view changes as the landscape on either side of the road is mostly comprised of native trees and vegetation. However, current views are limited to road users.
Visual impact of the proposal	The road corridor would be widened with associated removal of grassed verge and some trees. However, existing screening through fences and vegetation would limit views of the road corridor.	There would be noticeable changes in the road corridor including tree removal, new high rock-bolted wall with some areas of shotcrete, a reduction of bushland and a more open and urbanised road corridor.	Changes to the road corridor include removal of native trees and vegetation and the construction of a retaining wall. Views are limited to road users therefore visual impacts are lessened. Positive impacts include wider views of the landscape to the south.
Impact rating	Moderate-low	High-moderate	Moderate

6.4.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Landscape character and visual impact	<p>An Urban Design Plan will be prepared to support the final detailed proposal design and implemented as part of the CEMP.</p> <p>The Urban Design Plan will present an integrated urban design for the proposal, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The Plan will include design treatments for:</p> <ul style="list-style-type: none"> • Location and identification of existing vegetation and proposed landscaped areas, including species to be used • Built elements including retaining / rock-bolt walls • Pedestrian and cyclist elements including footpath location, paving types and pedestrian crossings • Fixtures such as seating, lighting, fencing and signs • Details of the staging of landscape work taking account of related environmental controls such as erosion and sedimentation controls and drainage • Procedures for monitoring and maintaining landscaped or rehabilitated areas. <p>The Urban Design Plan will be prepared in accordance with relevant guidelines, including:</p> <ul style="list-style-type: none"> • Beyond the Pavement urban design policy, process and principles (Roads and Maritime, 2014) • Landscape Guideline (RTA, 2008) • Bridge Aesthetics (Roads and Maritime 2012) • Shotcrete Design Guideline (RTA, 2016) • The Urban Design Plan would also take this environmental assessment and the urban design principles. 	Detailed designer	Detailed design	<p>Standard core safeguard</p> <p>Beyond the Pavement urban design policy, process and principles (Roads and Maritime, 2014)</p> <p><i>Landscape Guideline</i> (RTA, 2008)</p> <p>Bridge Aesthetics (Roads and Maritime 2012)</p> <p>Shotcrete Design Guideline (RTA, 2005)</p>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Visual impacts	Develop a limited range of materials, colours and textures for all built elements to achieve a simple uncluttered design. The types of materials proposed are to reflect the locality and be appropriate for its intended application.	Detailed designer	Detailed design	Additional safeguard
	<p>The Urban Design Plan would take the following visual aspects into consideration:</p> <ul style="list-style-type: none"> • Protect views to the local hills and surrounding vegetation • Include provision of shade and weather protection through the use of trees, vegetation and bus shelters • Medians, street lighting, pedestrian fences and walls would incorporate a simple, consistent design including the use of a limited range of materials, colours and textures • Minimise work on adjacent properties and opportunities for incorporation of design treatments would be reviewed pending any property acquisitions. 	Detailed designer	Detailed design	Additional safeguard
	Compounds, storage areas, stockpiles and associated work areas will be located in cleared or disturbed areas as far as possible.	Construction contractor	Construction	Additional safeguard
	The construction site will be kept tidy and rubbish free.	Construction contractor	Construction	Additional safeguard
	The site will be rehabilitated and landscaped with consideration of constraints within the corridor and in accordance with an approved landscape plan.	Construction contractor	Construction	Additional safeguard
Vegetation removal	Existing vegetation will be maintained and protected wherever possible. Trimming of trees rather than clearing will be carried out where possible.	Construction contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Light spill	<p>Temporary lighting for construction will be sited and designed to minimise light spill into residential properties and identified sensitive receptors.</p> <p>Any lighting during night time construction will be of short duration. Lighting will not be directed or spill into any adjoining landholding or dwelling. Occupants of adjoining dwellings would be advised of any night time construction and the proposed lighting requirements.</p>	Construction contractor	Construction	<p>Additional safeguard</p> <p>AS4282 – Control of the obtrusive effects of outdoor lighting, AS 1158.4:2015 <i>Lighting for roads and public spaces - Part 4: Lighting of pedestrian crossings</i></p>

6.5 Property and land use

6.5.1 Existing environment

The proposal is located in the township of Narara within a low density residential area with community facilities including a school, a college and a church within the proposal footprint. As outlined in Section 4.1.2, the land within and surrounding the proposal is within the following zones under the LEP (Figure 6-10):

- SP2 (Infrastructure)
- R2 (Low Density Residential)
- DM (Deferred Matter)
- RE1 (Public Recreation)
- IN1 (General industrial).

Key social and recreational infrastructure near the proposal are shown on Figure 6-10 and include:

- Gavenlock Oval, 700 metres east of the proposal
- Sensory park, 750 metres east of the proposal
- Paddy Clifton Oval, 850 metres east of the proposal
- C3 Church Narara Central Coast, 30 metres west of the proposal
- Narara Neighbourhood Centre 750 metres north west of the proposal
- Glenvale School, 20 metres west of the proposal
- St Philip's Christian College, 20 metres west of the proposal
- Narara Valley High School 800 metres north west of the proposal.

The proposal footprint is characterised by school facilities (Plate 6-1), vegetated areas (Plate 6-2) and residential dwellings (Plate 6-3).



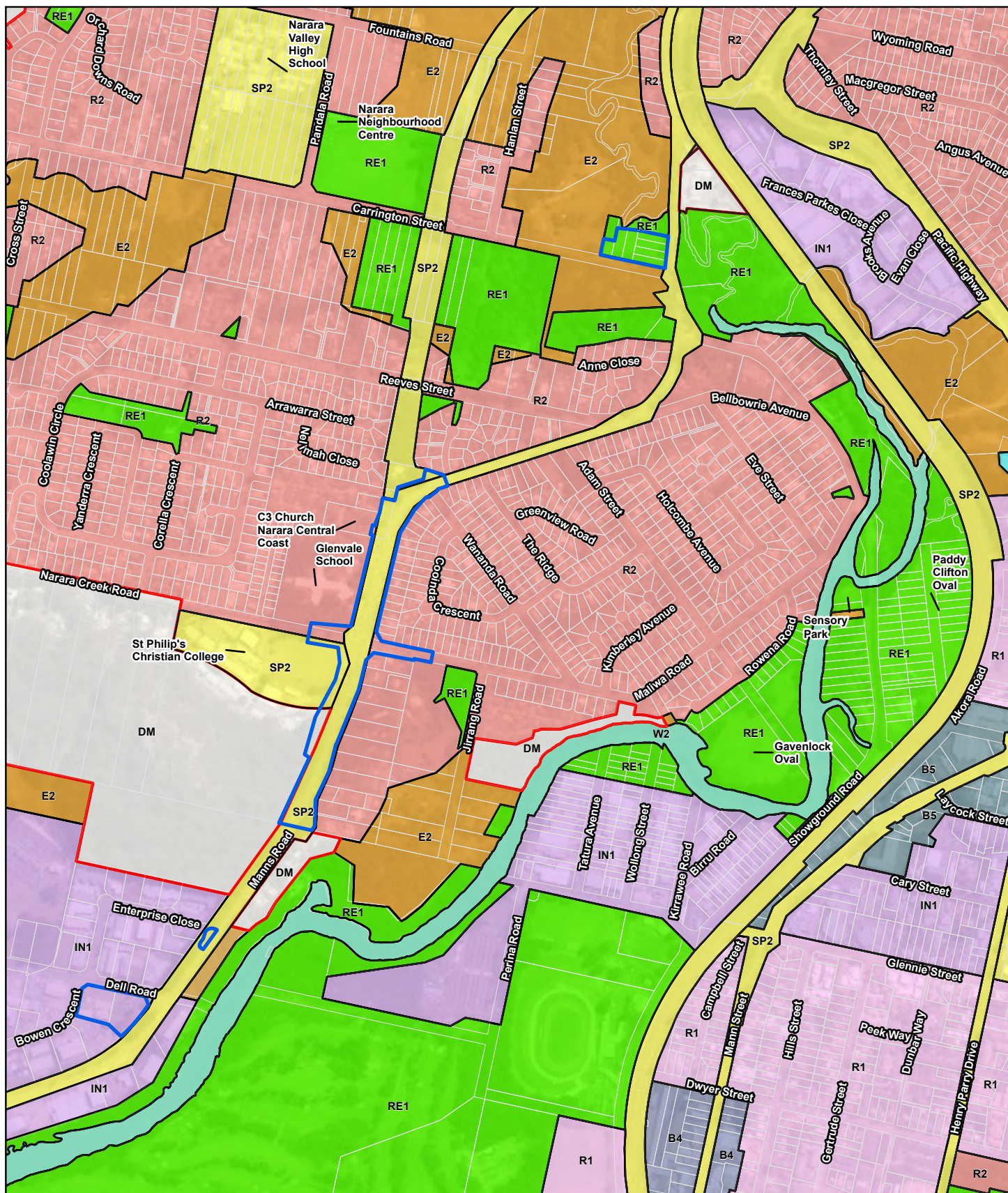
Plate 6-1: St Philip's Christian College



Plate 6-2: Vegetated area on the edges of Manns Road in the south of the proposal footprint



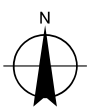
Plate 6-3: Residential dwellings adjacent to the Narara Creek Road intersection



LEGEND

Proposal footprint	B4 Mixed Use	IN1 General Industrial	SP2 Infrastructure
Cadastre	B5 Business Development	R1 General Residential	W2 Recreational Waterways
B2 Local Centre	E2 Environmental Conservation	R2 Low Density Residential	DM Deferred matters
	E3 Environmental Management	RE1 Public Recreation	

Paper Size A4
0 70 140 210 280
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Roads and Maritime Services
Manns Road Upgrade
Review of Environmental Factors
Narara Creek Road Intersection Upgrade

Job Number 22-19033
Revision 1
Date 05/10/2018

Land use zone

Figure 6-10

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6.5.2 Potential impacts

Construction

The road reserve in the proposal footprint would not provide sufficient area for construction of the road upgrade. While no full property acquisition would be required, four partial property acquisitions would need to occur (see Section 3.6 and the following *Operation* section for detail).

In addition, a number of temporary access agreements and leases would be needed, where Roads and Maritime would consult with private lot owners to gain temporary access to properties. This would include gaining temporary agreed access to properties for:

- Utility adjustments
- Minor driveway adjustments and restoration of private structures, such as fencing, on property boundaries
- Work on adjacent properties to where adjustments are required.

Negotiated leases would also be required for potential site compounds where lots are not already owned by Roads and Maritime.

The majority of lots are zoned R2 (low density residential), with the exception of Compound 1 which is RE1 (public recreation), Compound 2 which is IN1 (general industrial) and the St Philip's Christian College, which is SP2 (infrastructure) and DM (deferred matter). In the long term, the proposal is in accordance with the objectives of these zones, as improving access and road safety improves overall amenity of each zone. During construction, there may be negative impacts to amenity of these land use zones in the short-term (excluding SP2 infrastructure). Negative impacts would be mitigated using measures described in Section 6.5.3.

Construction of the proposal including driveway adjustments on private properties has the potential to temporarily impact the amenity of the property due to traffic and access issues, increases in noise, visual impacts and potential dust generation during construction of the proposal. These potential impacts and safeguards have been addressed in other sections of this REF, as follows:

- Noise and vibration (Section 6.1)
- Socio-economic effects (Section 6.3)
- Visual impacts (Section 6.4)
- Traffic and access (Section 6.8)
- Air quality (Section 6.10).

While the construction corridor would temporarily alter the land use from the existing R2, SP2 and DM, all of these areas are currently next to a road corridor and therefore is considered a negligible impact on land use. However, Compound 1 would temporarily alter the land use from public recreation to use as a construction compound. This could have short-term impacts on the community who may use the area for recreation activities. These issues would be addressed through any negotiated lease agreement and before signing of such an agreement by both parties.

Roads and Maritime would consult with potentially affected landholders and the local community before and during construction to minimise the potential for impacts on existing land use, as described in the safeguards and management measures (Section 6.5.3).

Operation

The proposal would involve the upgrade of an existing road, rather than construction of a new road. As such, there would be no alteration of land use from existing conditions. A small area of currently low density residential and deferred matter zoned land would be rezoned as infrastructure where partial strip acquisition is required to accommodate road widening.

Based on the concept design and subject to negotiations in accordance with the *Land Acquisition Information Guide* (Roads and Maritime Services, 2013) and the *Land Acquisition (Just Terms Compensation) Act 1991*, four individual properties would be directly impacted for the road widening and would be subject to partial acquisition (see Section 3.6, Figure 3-8). Two of the impacted properties are residential dwellings and two are educational, comprising St Philip's Christian College and Glenvale School. Three of the impacted properties are zoned R2 (Low density residential), while one is located across two land zones, namely SP2 (Infrastructure) and DM (deferred matter).

Details of direct property acquisition including are provided in Section 3.6, which shows an average of 2.3 per cent of each property would be affected by the proposal, ranging in area from 0.001 to 0.203 hectares. The area and percentage acquisition of each property is relatively low and would not involve any direct impact to existing buildings. However, some adjustments to driveways would be required with associated retaining wall construction at the corner of Maliwa and Manns Road and there could be some loss of infrastructure such as fencing or landscaped areas.

The impacts during operation would vary depending on individual owner circumstances, however, it is expected due to the small scale of the proposed acquisitions, the activities currently conducted at the affected properties would be largely unaffected on residual land not subject to acquisition. During operation, existing access arrangements for properties would be restored. The Manns Road/Narara Creek Road intersection would likely alleviate traffic-related impacts to these properties.

Further consultation with property owners about impacts to their property and activities due to acquisition would be carried out prior to construction to further inform the proposal, as described in the safeguards and management measures (Section 6.5.3).

6.5.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Property acquisition	All property acquisition will be carried out in accordance with the <i>Land Acquisition Information Guide</i> (Roads and Maritime, 2012) and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> .	Roads and Maritime	Detailed design	Standard core safeguard <i>Land Acquisition Information Guide</i> (Roads and Maritime, 2012) <i>Land Acquisition (Just Terms Compensation) Act 1991</i> .
	Carry out regular and ongoing engagement with the property owners affected by property acquisition.	Roads and Maritime	Detailed design	Additional safeguard
Adjacent land use impacts	Consult with potentially affected landholders before and during construction in accordance with the Communication Plan described in Section 6.3.4 to minimise the potential for impacts on land use.	Roads and Maritime	Detailed design	Additional safeguard
Neighbouring residential properties	Maintain safe access to impacted properties along Manns Road, Narara Creek Road and Maliwa Road during construction. Any disruption to access and properties will be minimised and will only be carried out following consultation and agreement with individual property owners affected by the work.	Construction contractor	Construction	Additional safeguard

6.6 Soils and geology

6.6.1 Methodology

A desktop review was carried out to inform the geotechnical investigation design and existing environmental conditions, including the following sources:

- Site history review including available desktop information and historical aerial photographs
- Review of geology, hydrology and topography information for the proposal footprint including the geotechnical factual report for the Pacific Highway and Manns Road Upgrade between Narara Creek Road and Parsons Road (SMEC, 2016)
- Review of NSW EPA record of notices and sites notified to the EPA under the *Contaminated Land Management Act 1997* (CLM Act) POEO Environmental Protection Licence (EPL) Register
- Review of Gosford City Council database for Development Applications
- A general inspection of the proposal footprint to identify areas of potential contamination concern.

Geotechnical investigations were then conducted within the proposal footprint between October and December 2017, comprising twelve pavement cores (PC34 – PC45), six test pits (TP48, TP51 – TP55), five boreholes (BH15 – BH20) and two hand augers (HA01 and HA02) (Figure 6-11). Pavement coring was carried out to full pavement depth or a maximum of 300 millimetres, while test pits were drilled or excavated to a maximum depth of two metres below the existing ground level.

Testing and sampling at test pits included dynamic cone penetrometer testing to assess relative soil density/strength, laboratory analysis of contamination, acid sulphate soils (ASS) and potential chromium reducible sulphate analysis. Borehole testing and sampling included standard penetration testing to assess the soil consistency/density strength, strength index testing, contamination testing, ASS screening (field indicator testing) and potential chromium reducible sulphate analysis.

6.6.2 Existing environment

Regional geology

Reference to the 1:100,000 scale Regional Geology Map for Gosford - Lake Macquarie (sheet 9131 and part sheet 9231) shows the proposal footprint and Compound 2 are underlain by the Middle Triassic aged Terrigal Formation of the Narrabeen Group and Gosford Subgroup. The Terrigal Formation (Rnt) comprises interbedded laminate, shale and fine to coarse grained quartz to quartz-lithic sandstone and minor red claystone.

Compound 1 differs to other parts of the proposal footprint and is underlain by Cenozoic Quaternary gravel and sand.

Topography

North of the Dell Road intersection, natural surface levels climb moderately from the alluvial plain to the south. Along this rise in grade, surrounding natural surface levels ascend steeply to the west and fall to the east to just south of Narara Creek Road. Along this portion of road, sandstone and siltstone bedrock strata are exposed in two cuttings on the western side of Manns Road, while a number of retaining walls are located along the eastern side. From about 100 metres south of the Narara Creek Road intersection, shallow cuttings are exposed on both the eastern and western side of Manns Road. These cuttings decrease in height towards Narara Creek Road.

Compound 1 is located on a flat surface and resides next to a creek with sloping riparian banks. Compound 2 resides downslope of the proposal footprint, on a level floodplain.

Soil landscape

Reference to the 1:100,000 scale Gosford-Lake Macquarie Soil Landscapes Sheet indicates the proposal and Compound 2 is underlain by the Erina erosional landscape. The Erina erosional landscape is characterised by undulating to rolling rises and low hills on the Terrigal Formation. Local relief is typically less than 60 metres and slope gradients are generally less than 25 per cent. Landforms include rounded narrow crests with moderately inclined slopes. Soil profiles are typically moderately deep to deep (100 centimetres to greater than 200 centimetres) with dominant soils comprising sandy loam and/or clayey loam horizons overlying medium sandy clay, light to medium strongly pedal clay and medium and or massive sandy clay loam. Potential limitations include localised mass movement, high soil erosion, foundation hazard (localised), seasonal waterlogging of footslopes, strong acidity and high plasticity/moderate shrink-swell potential.

Compound 1 resides on alluvial soils from the Yarramalong erosional landscape. This landscape is characterised by level to gently undulating alluvial plains. Local relief is less than 10 metres, with slope gradients under five per cent. Soils in the Yarramalong erosional landscape comprise deep alluvial soils and siliceous sands. Limitations include flooding, foundation hazard and seasonal waterlogging.

Geotechnical investigations determined the proposal site is characterised by fill materials (up to 3.3 metres deep) overlying mostly residual soil to a maximum of 4.3 metres below the existing surface and then bedrock. Colluvial soil was encountered within existing slopes along the west of Manns Road, south of Narara Creek Road intersection. Colluvial soil was described as clayey sand and sandy clay of respective medium dense and stiff to hard consistency. Encountered general fill comprised variable fill materials in the road reserves and adjacent to the existing carriageways and ranged from clayey sand, gravelly sand, sandy gravel, sand and clayey gravel 'non-cohesive' soils to clay, sandy clay and gravelly clay 'cohesive' soils. No topsoil was encountered at geotechnical test locations within the proposal footprint.

Acid sulphate soil

Reference to the 1:25,000 scale ASS Risk Map for Gosford (Department of Land and Water Conservation, ref. 9131-S2, Edition 2) found there are no mapped risks within the proposal footprint. This was confirmed by screening tests for actual and potential ASS during geotechnical investigations for the proposal, which did not detect occurrences of ASS or potential ASS within the proposal site.

The risk map also identified Compound 1 has a low probability of occurrence of ASS. Potential for ASS within Compound 2 has not been assessed as part of the risk mapping for Gosford, although the compound is located on a pre-existing concrete substrate which is proposed to be retained during compound operation and therefore ASS risk is considered low.

Contamination

The search of contaminated land record of notices notified to the EPA revealed two documented contaminated sites, as follows:

- Metro Meats Ltd premises, located at 356 Manns Road, which is located more than two kilometres south of the proposal
- Caltex, located at 283 Manns Road is about 1.3 kilometres south west of the proposal.

Further, the following potential existing sources of contamination have been identified within and around the proposal footprint:

- Historical use of herbicides and pesticides
- Spillage or leakage of oils, fuels
- Fill material from unknown sources
- Existing bitumen and road base
- Illegal dumping of waste along the road corridor
- Migration of contamination (surface water and groundwater) from the existing motor registry office at Compound 2.

However, the soil sampling for contamination within the proposal footprint found the following:

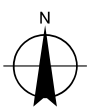
- No odours or staining was observed during the collection of soil samples
- There were no visual signs of contamination noted within the boreholes and test pits excavated during the assessment
- All soil samples reported concentrations below the adopted assessment criteria for all parameters.



LEGEND

- | | | |
|---|---|--|
| Proposal footprint | High probability of acid sulphate soil | Disturbed Terrain |
| Concept design | Low probability of acid sulphate soil | ● hand auger |
| — Contour | | + pavement core |
| | | + test pit |

Paper Size A4
0 70 140 210 280
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Roads and Maritime Services
Manns Road Upgrade
Review of Environmental Factors
Narara Creek Road Intersection Upgrade

Job Number 22-19033
Revision 1
Date 05/10/2018

Existing soil environment

Figure 6-11

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6.6.3 Potential impacts

Construction

Exposure of soil to erosion

The southern portion of the proposal footprint would be excavated to decrease the grade and increase the line of sight on Manns Road just south of Narara Creek Road. The road would also be widened in this area which would require excavating into the steep slope south west of the proposal footprint. These activities would increase the risk of soil erosion during construction as soil would be exposed and open to disturbance. Where cut slopes are being constructed, the diversion of surface water at the top of the slope would be implemented using temporary measures.

Grassed areas between the existing road and private properties along Manns Road would also be cleared during construction including grassed road verge to the north west and south east of the intersection. During construction, these areas would be exposed and soil would be disturbed which is currently covered, increasing the risk of erosion.

Soil erosion could cause downstream impacts, including siltation of watercourses and water storages and reduction in the water quality of creeks and other waterways, as described in Section 6.1. Stockpiles of a small amount of topsoil and fill material may be susceptible to erosion if not appropriately stabilised with covering or seeding. In addition, stockpiles would be susceptible to erosion if not located outside of flood affected areas and drainage lines. While the proposal footprint is mostly outside of the flood affected area, Compound 1 and parts of Compound 2 are within the mapped 100 year flood event extent. Sediment controls would be required around the boundaries of the compounds.

With the implementation of sediment and erosion controls as described in Section 6.6.4, no significant impacts on soil are expected.

Disturbance of acid sulphate soils

Disturbance of ASS during construction is not anticipated given ASS were not detected within the intersection upgrade area during preliminary geotechnical investigations. As discussed in Section 6.6.2, Compound 1 has a low ASS risk. ASS risk in Compound 2 has not been assessed, although the soil in the compounds is not expected to be disturbed. The majority of Compound 2 is also built on concrete substrate which would not be disturbed for the proposal.

Mobilisation of existing or unexpected contamination

Results from the contamination investigation reported contaminant concentrations below the adopted health assessment criteria for all samples analysed. This indicates soils in the proposal footprint are unlikely to present a health risk to workers during construction work and future site users post construction. Further, all samples were within the ecological investigation criteria indicating risk to sensitive environmental receivers is also low.

No significant human health or environmental risks to construction workers or future site users have been identified; no remediation within the site is proposed at this stage.

Vegetation to be cleared for the proposal would be mulched and used where possible on site. Stockpiling of mulched material has the potential to result in tannin runoff which may potentially impact on soil or water acidity. Compound 1 has the potential to impact nearby waterways including Fountain Creek and Narara Creek downslope of the compound if tannin runoff occurs. Where stockpiling of vegetation is required, the appropriate management measures would be required.

While there is no existing known contamination in the proposal footprint, there is always the potential to encounter previously unknown contamination during construction. Further, the proposal has the potential to cause soil contamination from accidental spills or leaks of fuels, oils and other chemicals from equipment and vehicles during construction. The management measures outlined in Section 6.6.4 would be implemented to mitigate the potential impacts identified.

The management measures outlined in Section 6.6.4 would be implemented to mitigate the potential impacts identified throughout this section.

Operation

There would be slight changes to topography of the crest of Manns Road, causing changes to the drainage and runoff patterns of Manns Road. However, the proposed drainage upgrade has been designed to account for the upgraded road and the topography changes would not alter the end discharge point.

The risk of soil erosion during operation would be minimal as all areas impacted during construction would be sealed or rehabilitated and landscaped to prevent soil erosion.

6.6.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Contaminated land	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other work that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA.	Construction contractor	Construction	Core standard safeguard Section 4.2 of QA G36 <i>Environment Protection</i>
Exposure of soil to erosion	A soil and water management plan (SWMP) will be prepared as part of the CEMP in accordance with the requirements of Roads and Maritime contract specification G38 prior to the start of construction. The SWMP will address the following: <ul style="list-style-type: none"> • Roads and Maritime <i>Code of Practice for Water Management, the Roads and Maritime Erosion and Sedimentation Procedure</i> • The NSW Soils and Construction – <i>Managing Urban Stormwater Volume 1 ‘the Blue Book’</i> (Landcom, 2004) and Volume 2 (DECC, 2008) • <i>Roads and Maritime Stockpile Site Management Guideline</i> (Roads and Maritime, 2015) • <i>Technical Guideline: Temporary Stormwater Drainage for Road Construction</i>, (Roads and Maritime 2011) • <i>Technical Guideline: Environmental Management of Construction Site Dewatering</i>, (Roads and Maritime 2011). 	Construction contractor	Construction	Additional safeguard QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Prepare and implement a progressive erosion and sediment control plan prior to the start of each stage of construction. The plan would include a provision for disturbed areas of the site to be progressively scheduled for ground stabilisation and / or final landscaping treatment where possible at the end of each construction stage.	Construction contractor	Construction	Additional safeguard
	Develop an inspection and maintenance programme to check the adequacy of controls, particularly after a rainfall event.	Construction contractor	Construction	Additional safeguard
	Erosion and sediment controls would be retained and maintained until effective soil cover (at least 70 per cent coverage) is achieved.	Construction contractor	Construction	Additional safeguard
	Controls will be implemented at exit points to minimise the tracking of soil and particulates onto pavement surfaces. Any material transported onto pavement surfaces will be swept and removed at the end of each working day.	Construction contractor	Construction	Additional safeguard
Accidental spill	<p>A site specific emergency spill plan will be developed for inclusion in the CEMP, and include spill management measures in accordance with the Roads and Maritime <i>Code of Practice for Water Management</i> (RTA, 1999) and relevant EPA guidelines.</p> <p>The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).</p>	Construction contractor	Construction	<p>Core standard safeguard Section 4.3 of QA G36 <i>Environment Protection</i></p> <p>Roads and Maritime <i>Code of Practice for Water Management</i> (RTA, 1999)</p>
	Fully equipped emergency spill kits would be kept on-site at all times	Construction contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Storage and disposal of construction materials	Excess spoil not required or able to be used for backfilling would be stockpiled in a suitable location before being reused or removed from the site, and disposed of appropriately in accordance with the NSW EPA <i>Waste Classification Guidelines</i> (2014).	Construction contractor	Construction	Additional safeguard NSW EPA <i>Waste Classification Guidelines</i> (2014)
	As part of the CEMP, measures for the management of mulch and tannin generated from clearing on the site will be prepared in accordance with the Roads and Maritime <i>Management of Tannins from Vegetation Mulch</i> (2012).	Construction contractor	Construction	Additional safeguard Roads and Maritime <i>Management of Tannins from Vegetation Mulch</i> (2012).

Other safeguards and management measures which would address soil impacts are identified in Section 6.7.

6.7 Surface water and flooding

6.7.1 Existing environment

Catchment overview

The southern 200 metres of the proposed upgrade and Compounds 1 and 2 are within the lower Narara Creek subcatchment, while the remaining proposal footprint is within the Fountain Creek subcatchment. There are four drainage lines which control runoff from the lower Narara Creek subcatchment that drain to Manns Road, with drainage line 4 draining into the western point of Dell Road, about 600 metres southwest of the proposal footprint. The upper area of the Lower Narara Creek and Fountain Creek subcatchments is native forest with pockets of agricultural land. The lower area of Lower Narara Creek subcatchment flows through the West Gosford industrial area, while the lower part of Fountain Creek subcatchment is low density residential. Figure 6-12 shows key drainages and the local sub-catchments as they relate to the proposal footprint.

Surface Water

The majority of the proposal footprint is urbanised with established stormwater drainage infrastructure already in place. Manns Road grades in a north-south direction near the Narara Creek Road intersection with a crest located just south of the intersection. The southern portion of Manns Road therefore drains to an existing drainage pipe crossing under Manns Road at southern limit of work (Figure 6-12), which is then piped out towards the east where it outlets into a ponded area before grassed overland flow into Narara Creek.

The northern portion of the proposal, including Narara Creek Road and Maliwa Road, drains to a drainage reserve via existing culverts opposite Wananda Road intersection. This drainage reserve outlets into a small tributary which joins Narara Creek about 300 metres north of the proposal footprint.

Compound 1 is located next to a drainage line connecting to a tributary of Narara Creek, while Compound 2 is connected to existing stormwater drainage which outlets directly into Narara Creek via a dish drain.

Narara Creek flows in a southerly direction away from the proposal. Near the proposal footprint, Narara Creek is about 40 metres wide and is influenced by tidal movements. The proposal footprint does not directly impact on Narara Creek.

Narara Creek discharges to Brisbane Water estuary about 1.2 kilometres south of the proposal. Brisbane Water is a nationally important wetland due to the relatively large areas of mangrove, saltmarsh and seagrasses. The proposal footprint does not directly impact on Brisbane Water.

Flooding

The most common forms of flooding in the Gosford region are flash flooding, due to intense rainfall within the catchment, tidal action such as a king tide, and storm surge associated with storms off the east coast of Australia. The Gosford LEP 2014 contains flood mapping for part of the Central Coast Council local government area containing the proposal (Figure 6-13). This mapping has been done for the one per cent annual exceedance probability (AEP) flood event. The mapping shows the intersection is outside the area potentially impacted by the one per cent AEP and above the nominated flood planning levels, although it could still be affected by localised road flooding from overland flood flows and road surface drainage. However, the location of Compound 1 and parts of Compound 2 are within the mapped one per cent AEP flood area, which comprises catchment flooding from Narara Creek backwater.

Baseline hydrologic and hydraulic modelling was also conducted by Lyall and Associates for the proposal (Lyall and Associates, 2018) to compare drainage and flooding behaviour for the larger Manns Road Upgrade Stockyard Place to Narara Creek Road, Stage 5 concept design, which also covers the proposal area. Flood modelling for existing conditions determined the location of Compound 2 near Dell Road would be affected by up to 0.6 metres of inundation in a 100 year ARI flood event, but not in a potentially more frequent 10 year event. While the existing commercial buildings are not predicted to be affected, the surrounding car park area which would be utilised as a potential compound would be impacted.

6.7.2 Potential impacts

Construction

Flooding

The construction work would include upgrade of existing drainage, during which there is potential for short durations where existing drainage facilities would be out of use. In the event a rainfall event occurred during this time, there could be an increase in localised flooding. However, the construction would be staged, which would prevent all stormwater drains and pipes from being offline concurrently, which would reduce this impact. Further, the duration of drainage facilities being out of operation would be short-term.

Flooding from overland flows during construction has the potential to impact on water quality due to erosion and sedimentation and contamination, particularly during any excavation work. However, the intersection is located outside of flood prone land so with the implementation of safeguards recommended in Section 6.7.3, this impact is not likely to be significant.

The proposed construction compounds are both located within the mapped 100 year flood event. Should a flood event occur that affects the compounds, there is risk of mobilisation of fines from stockpiled materials, or chemicals and fuels which may be stored within the site. Safeguards specified in Section 6.7.3 would mitigate this risk.

Surface water

Construction activities have the potential to impact on water quality as described in Table 6-20. Water quality degradation could impact aquatic habitats and Coastal Management SEPP Wetlands, should appropriate controls not be in place. However, due to the size of the receiving environments and the distances from the proposal these are not expected to be substantial.

With the implementation of safeguards for pollution and sediment controls recommended in Section 6.7.3, this impact is not likely to be significant.

Table 6-20: Summary of key surface water hazards and impacts

Activity	Hazard	Potential impact
<ul style="list-style-type: none">Vegetation clearingTopsoil strippingBulk earthworkDrainage work including clearing of culvert debrisServices / utilities relocationMaterial stockpiling	Sediment laden runoff from disturbed areas and stockpiles	Reduced water quality in local waterways due to increased turbidity and sediment loading
	Mobilisation of soil nutrients into waterways	Eutrophication of aquatic habitat
<ul style="list-style-type: none">Construction equipment and machinery operationStorage of fuels or chemicals within compoundsPaving activities	Accidental fuel or chemical spill	Contamination of surface and groundwater by petroleum hydrocarbons or other hazardous materials
Utility relocation and commissioning	Release of chlorinated water	Alter the water quality of receiving waters and potential toxicity of aquatic biota

Activity	Hazard	Potential impact
Concreting activities including drainage culvert construction	Concrete slurry spills	Contamination of surface water with concrete slurry
General construction	Accidental release of waste into waterways	Aquatic fauna injury / mortality

Operation

Flooding

The proposal footprint is located outside the 100 year flood extent, with the exception of Compound 1 and Compound 2, which would be decommissioned following construction and therefore would not present an operational impact.

Hydrology and drainage

One objective of the design of the proposal has been to maintain the existing hydraulic regime of the watercourses near the proposal footprint. As described in Section 3.2.3, changes to the sizes and locations of some existing road surface drainage and associated stormwater pits are proposed to achieve hydraulic design standards as described in Table 6-21. However, no significant impact to hydrology is likely as there is no change to the locations where existing and upgraded drainage lines discharge and no significant diversion of flow between catchments and watercourses.

The drainage design is still under development and would be further refined during the detailed design stage.

Table 6-21: Minimum average recurrence interval requirements

Item	Minimum average recurrence interval
Channels and open drains	5 years
Piped system (including pits)	10 years
Culverts where surcharge is allowable	50 years
Structures where surcharge is undesirable	100 years
Nil width of flow spread onto traffic lanes	10 years
Gross pollutant traps	1 year
Pavement drainage wearing surface	10 years
Major storm event check for no property damage	100 years
Major storm event check for no structural damage	2000 years
Cycleway	1 year
Temporary drainage	2 year

6.7.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Surface water pollution	A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction.	Construction contractor	Construction	Core standard safeguard Section 2.1 of QA G38 <i>Soil and Water Management</i>
Soil and water	A site specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the SWMP. The Plan will include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.	Construction contractor	Construction	Core standard safeguard Section 2.2 of QA G38 <i>Soil and Water Management</i>
Water quality	Specific measures to be incorporated into the SWMP include: <ul style="list-style-type: none"> • Use existing grass lined drainage channels for clean water diversion where available • Install additional stabilised diversion drains where necessary to separate clean and dirty areas and incorporate necessary sediment and erosion controls • Treat highly chlorinated water prior to release in accordance with water company guidelines. 	Construction contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Flooding and hydrology impacts	<p>The SWMP would include measures to maintain surface water flows during work on existing and new drainage and avoid localised flooding of the road and adjacent properties including:</p> <ul style="list-style-type: none"> • The provision of temporary alternative drainage arrangements during work on existing drainage lines • Removing debris, soil/gravel, equipment and other obstructions routinely following periods of work and before forecast wet weather • Not stockpiling materials below the mapped 10 year flood level in accordance with blue book requirements • Regular inspection during high rainfall events • Scheduling work wherever possible during low rainfall periods. 	Construction contractor	Construction	Additional safeguard

6.8 Traffic and transport

This section addresses the potential traffic and transport impacts associated with the proposal and details the management measures proposed to mitigate these impacts.

6.8.1 Methodology

The traffic and transport assessment comprised the review of existing conditions through surveys and a traffic modelling and simulation analysis by Cardno (Cardno, 2018). The full traffic and transport report for this proposal and another intersection proposal (southbound approach to Stockyard Place intersection) is provided in a specialist technical report in Appendix I (Volume 2).

Traffic surveys

Traffic surveys were conducted across the proposal to survey existing conditions, which comprised:

- Automatic tube counts to identify 24 hour traffic volumes
- Intersection counts to identify peak hour turning volumes at intersections
- Origin destination survey to understand where traffic is coming from and going to
- Travel time survey to understand how long it takes to travel along specific sections of road.

These surveys informed traffic demands for the traffic model and the creation of peak hour profiles.

Modelling

Traffic modelling was conducted to assess intersection performance for existing conditions/base case (2017), plus future case for 2026 and 2036 based on projected traffic growth (low and high scenarios). A comparison was provided for the 'with proposal' (build) and 'do nothing' (no build) scenarios. The modelling considered three peak hours, comprising weekday morning, weekday evening and Saturday peak hour. Traffic performance was assessed in terms of level of service, as defined in Table 6-22.

Table 6-22: Level of service definitions

Level of service	Intersection performance – average delay per vehicle (seconds)	Road performance (relating to a specific section of road) – average travel speed as a percentage of allowable sign-posted speed
A	0 – 14	More than 85 % (ie above 51 kilometres per hour for a 60 kilometre per hour zone)
B	14 – 28	67 – 85 %
C	29 – 42	50 – 67 %
D	43 – 56	40 – 50 %
E	57 – 70	30 – 40%
F	More than 70	0 – 30%

6.8.2 Existing environment

Road network

Manns Road is an arterial road in West Gosford which allows traffic to bypass the Gosford central business district for vehicles travelling between the Pacific Motorway and Gosford's northern suburbs.

Manns Road is generally one traffic lane in each direction with a sealed shoulder which also functions as a cycle lane. There are two intersections on Manns Road within the proposal footprint, namely Narara Creek Road/Maliwa Road and Wananda Road intersections. Only the Narara Creek Road/Maliwa intersection has traffic lights. The current intersection is located on a crest and this has implications for sight distance on Manns Road approaching the current traffic signals in both directions.

The existing posted speed limit on Manns Road through the proposal footprint is 60 kilometres per hour. There is one school zone located on Narara Creek Road, with 40 kilometre per hour speed limits between 8 to 9.30am and 2.30 to 4pm. Outside of these hours, the speed limit is 50 kilometres per hour, which is consistent with the Maliwa Road speed limit.

Formal pedestrian footpaths are not currently consistent throughout the proposal footprint. Paths are located on:

- Narara Creek Road eastbound and westbound throughout the proposal footprint
- The west of Manns Road for 200 metres north from the intersection

There are road markings for cyclists in the shoulder northbound on Manns Road from 70 metres north of the intersection to the proposal extent, but no other formal cycle facilities exist in the proposal footprint.

While there are no formal on-road parking facilities in the proposal footprint, where access is available to the wider parts of the grassed verges and some paved shoulders, particularly in the west of the proposal, there is opportunity for informal parking and temporary stopping. No stopping signs are in place near the approaches to the intersection to prevent parking on the adjacent road shoulder which may interfere with cyclist safety and obstruct visibility for motorists approaching the intersection.

Traffic and road safety

There is currently up to 18,000 vehicles per day using Manns Road within the proposal footprint, with congestion and delays experienced during peak periods. The hourly traffic profile over a 24-hour surveyed period indicates the Manns Road corridor has a typical weekday traffic pattern with a morning northbound peak period between 8am to 9am and a southbound afternoon peak period from 3pm to 4pm. There is also a Saturday peak hour between 11am and 12pm in both directions. Traffic surveys also identified congestion of northbound traffic along Manns Road approaching the proposal footprint for the weekday afternoon and Saturday peak periods due to delays at the existing signals at Narara Creek Road.

The current level of service for the Narara Creek Road intersection and the approach to the intersection from the south (between Dell Road and Narara Creek Road) is B, with an average delay of 17 seconds per vehicle and speeds reduced to an average of 43 kilometres per hour (72 per cent of the sign posted speed).

In the five years between 2013 and 2017 there were six reported crashes at Narara Creek Road intersection and five on Manns Road up to 400 metres north and 400 metres south of the intersection. The majority of crashes involved a rear-end collision. The next most common involved turning in front of an oncoming vehicle then collision at the intersection between approaching vehicles.

Public transport

Three bus routes service Manns Road in the proposal footprint. Bus Services 33 and 55 run in both directions from Brisbane Water Drive via the proposal footprint to Narara Creek Road/Maliwa Road intersection and then further north of the proposal. Bus Service 36 runs north of Narara Creek Road. There are three bus stops within the proposal footprint as shown in Section 2.2.2, comprising:

- Glenvale School, northbound Manns Road – informal bus bay with bus shelter
- Maliwa Road after Manns Road, eastbound – bus shelter
- Maliwa Road before Manns Road, westbound – bus stop signpost.

6.8.3 Potential impacts

Construction

Partial road closures and construction speed limits

Temporary traffic arrangements would be planned and implemented during work to provide for the safety of road users and construction staff. These could include modification to lane widths or road shoulders, use of separation barriers, detours and temporary signage.

Construction speed limits (typically 40 kilometres per hour) may apply to Manns Road and local roads next to the construction site and at site compounds. These could lead to short-term travel delays for motorists, but given the limited extent of the proposal and the existing congestion, it is anticipated these impacts would be localised and of a short duration, although some congestion on Manns Road either side of the proposal could occur.

Construction is expected to take up to about 18 months and impacts would be variable throughout this period depending on the construction stage. Construction staging would be developed to minimise impacts on the road network. Where possible, construction activities which could substantially affect traffic congestion would be carried out outside peak periods to mitigate the impact to the community, as far as is practicable.

Construction traffic generation

Construction of the proposal would generate heavy vehicle movements. These heavy vehicle movements would mainly be associated with:

- Delivery of construction materials
- Spoil and waste removal
- Delivery and removal of construction equipment and machinery.

Light vehicle movements would be required for the movement of construction personnel, including contractors, site labour force and specialist supervisory personnel. As detailed in Section 3.3.7, peak construction traffic (with a likely duration of about one month) is expected to be in the order of:

- Up to 210 heavy vehicle movements per day
- Up to 180 light vehicle movements per day.

Construction vehicles would access the site via Manns Road from the north and south. It is not anticipated local roads would be utilised to access the proposal footprint. Heavy vehicle traffic would be restricted, as much as possible, to main roads such as Manns Road to minimise impacts on local roads. Short-term manual traffic control may be used to manage heavy vehicle entry and exit from the construction site and compounds. This may result in minor traffic delays for motorists, however, these delays would be localised and of a short duration.

The estimated construction traffic movements are small when compared to the existing traffic volumes in the area of between 11,000 and 18,000 vehicle movements per day and are therefore not expected to impact the traffic and transport environment of the proposal footprint. Potential impacts, including those potentially affecting local roads next to the proposal, would be managed through the development of a construction traffic management plan and appropriate consultation with affected parties.

Access

Potential impacts associated with construction of the proposal may include access disruptions at existing intersections near the proposal (for example, Wananda Road) and accesses for property owners within the proposal footprint. Vehicular access to some properties may be restricted for short periods during the construction work following appropriate consultation with impacted property owners.

Where access to property would be disrupted for an extended period, alternative access would be provided. Similarly, pedestrian access to properties would be maintained at all times.

On-road parking

Informal parking on both the eastern and western verge of Manns Road and Maliwa Road may be temporarily restricted during construction to allow space for traffic diversions and construction work. Parking on verges is informal and uncontrolled, but may inconvenience some road users such as residents or visitors to the schools or church within the proposal footprint.

The loss of informal on-road parking within the proposal footprint would be minimal and on-street parking is available on side streets in addition to opportunities for off-street parking within residences along Manns Road and within the school grounds.

Public transport

There is no expected impact on public transport. All existing bus services would be maintained during construction. Bus detours would not be required, although bus stops may require temporary relocation to accommodate construction work. The existing bus bay next to Glenvale School north of the intersection would be permanently removed as part of the work, which is discussed further under the operation impact section.

Pedestrians and cyclists

Pedestrians and cyclists would be affected during construction, with existing footpaths likely to be impacted at various stages of construction. However, construction of the footpath on the western verge of Manns Road is the first stage of construction, which would allow use of this facility during remaining construction work. Pedestrians and cyclists would be provided safe access across and along Manns Road at all times during construction and diversions would be provided. Pedestrian and cyclist diversions and access would be addressed in the traffic management plan for the proposal.

Operation

Future intersection performance

Traffic modelling predictions of the performance of Manns Road between Narara Creek Road and Dell Road and the intersection of Manns Road, Narara Creek Road and Maliwa Road is provided in Table 6-23. The modelling found the performance of the intersection would stay the same or improve with the upgrade, with the exception of morning peak hour in 2036 under high traffic growth, where a reduction in intersection performance is predicted. However, for the section of Manns Road between Dell Road and Narara Creek Road, the upgrade of the intersection is predicted to improve the northbound traffic by at least two levels of service for all peak hours for both low and high growth scenarios until 2036. Southbound traffic exiting the intersection is also predicted to stay the same or improve until all scenarios with the proposal upgrade in place.

Table 6-23: Level of service with and without the proposal for 2026 and 2036

Year	Location	Low traffic growth		High traffic growth	
		No proposal	With proposal	No proposal	With proposal
2026	Intersection performance	B	B	D	B
2036	Intersection performance	B	B	D	B (afternoon and Saturday peak hours) F (morning peak hour)
2026	Southbound between Narara Creek Road and Dell Road	A	A	B	A
	Northbound between Narara Creek Road and Dell Road	C	A	C	A
2036	Southbound between Narara Creek Road and Dell Road	A	A	F	C
	Northbound between Narara Creek Road and Dell Road	C	A	D	A

Access

The construction of the central median would restrict access to/from residential properties along part of Manns Road to left in, left out only. This may require residents to take alternate routes. For residents coming from the south on Manns Road to access the properties on the eastern side, they may utilise side streets such as Glenmaggie Close to find safe routes to turn back. This would add up to 700 metres or one minute travel to the southernmost residential property.

There are no residences on the west of Manns Road which would have access impacted by the new central median. There is one driveway to access Glenvale School and one for the C3 Church which would be restricted to left in, left out only by the central median. However, during consultation with Glenvale School it was determined access is via Narara Creek Road only and therefore school access would not be impacted. For visitors of C3 Church coming from the north, an alternate route would be required to access the church from the south, or Maliwa Road could be utilised to turn around if safe to do so. This would add up to 550 metres or one minute travel to the facility.

This would be a long-term, negligible impact on a small proportion of residents in the area and visitors to C3 Church. However, the proposal would increase the capacity of Manns Road and Narara Creek Road/Maliwa Road at the intersection and improve road safety around the schools.

On-road parking

Informal parking on the verge of Manns Road within the proposal footprint would be permanently removed as part of the proposal. While parking on verges is informal and uncontrolled, the loss of informal parking spaces may affect some road users such as residents or visitors to the schools or churches.

The loss of informal on-road parking within the proposal footprint would be minimal and most residents and the schools and church have on-site car parking. Further, on-street parking is available on side streets on Maliwa Road and Wananda Road. This would be a permanent negligible impact affecting a small proportion of residents and visitors in Narara, but is anticipated to improve safety as discussed in the following sub-section.

Public transport

There are no anticipated impacts on local public transport as a result of the proposal. Some bus services could experience minor improvements due to the improved traffic flows and additional lanes through the intersection as a result of the proposal.

One bus bay would be removed as a result of the proposal, located on the west of Manns Road just north of the intersection. The proposed removal of the northbound bus bay just north of Glenvale School has the potential to reduce the access of residents or students, who may use this stop via public buses (bus number 36). However, during consultation, public buses were not identified by the school as a key mode of transport for students, so this is not expected to impact many students. A bus stop servicing the same route (northbound) on Maliwa Road is available within short walking distance (190 metres or a two-minute walk) of the current bus stop via a pedestrian crossing with traffic lights. This alternative bus stop is being upgraded with a sealed shoulder and footpath as part of the proposal.

Road user safety

The raised central median to the north and south of the intersection on Manns Road would improve traffic flow and road safety by decreasing the number of vehicles turning across oncoming traffic into properties, which currently comprises the second most frequent type of crash in the proposal footprint. Further, the reduction in crest height, widening of the road and intersection and provision of dedicated through and turning lanes would improve line of sight and road safety for motorists, pedestrians and cyclists approaching the intersection on Manns Road from the south.

The safety of pedestrians, cyclists and motorists would be improved as a result of providing a shared path (for use by both pedestrians and cyclists) on the western side of Manns Road and a pedestrian footpath on the eastern side of Manns Road. This would also join to a small existing footpath on Narara Creek Road further improving connectivity to local schools and residential areas. The provision for traffic light controlled pedestrian crossings on all legs of the intersection would also improve access and safety for pedestrians.

6.8.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Traffic and transport	<p>A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Roads and Maritime <i>Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10 Control of Traffic</i> (Roads and Maritime Services, 2008). The TMP will include:</p> <ul style="list-style-type: none"> • Confirmation of haulage routes • Measures to maintain access to local roads and properties • Site specific traffic control measures (including signage) to manage and regulate traffic movement • Measures to maintain pedestrian and cyclist access • Requirements and methods to consult and inform the local community of impacts on the local road network and any local parking changes • Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads • A response plan for any construction traffic incident • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • Monitoring, review and amendment mechanisms. 	Construction contractor	Construction	<p>Core standard safeguard</p> <p>Section 4.8 of QA G36 <i>Environment Protection</i></p> <p><i>Traffic Control at Work Sites Manual</i> (RTA, 2010)</p> <p>QA <i>Specification G10 Control of Traffic</i> (Roads and Maritime Services, 2008)</p>
Traffic congestion	Construction activities which could substantially affect traffic congestion will be carried out outside peak periods, as far as is practicable.	Construction contractor	Construction	Additional safeguard
	Heavy vehicle traffic will be restricted, as much as possible, to the existing main roads (such as Manns Road) to minimise impacts on local roads and streets.	Construction contractor	Construction	Additional safeguard
Access	Where access to property would be disrupted for an extended period, alternative access would be provided. Pedestrian access to properties will be maintained at all times.	Construction contractor	Construction	Additional safeguard

Other safeguards and management measures which would address traffic and transport impacts are also identified in Section 6.8.

6.9 Aboriginal heritage

6.9.1 Methodology

A desktop search was conducted on the following databases to identify any potential previously-recorded heritage within the proposal footprint:

- Commonwealth Heritage Listings
- National Native Title Claims Search
- OEH AHIMS
- Local Environment Plan (LEP).

An archaeological baseline assessment completed by Virtus Heritage to meet the Roads and Maritime Stage 1 PACHCI (Roads and Maritime 2011) was initially completed in February 2018, to assess the risk of impact to Aboriginal Cultural Heritage. Following the findings in that report, additional assessment of the potential for Aboriginal heritage in and around the proposal footprint has been conducted in a Stage 2 PACHCI investigation completed by OzArk. This included a site investigation, accompanied by Roads and Maritime personnel and two representatives of the Darkinjung Local Aboriginal Land Council on Tuesday 1 May 2018. Both technical reports are provided in Appendix F (Volume 2).

6.9.2 Existing environment

Desktop assessment

The landform of the proposal footprint includes slopes and a crest to the west of Manns Road in the south of the proposal footprint. This landform is prone to erosion and therefore if Aboriginal sites in the sloping landforms existed, it is likely they have been dispersed by erosion. The proposal footprint also has a long history of urbanism and agriculture which involved heavy clearing and modification of the landscape.

Notwithstanding the alteration of the landscape, the proposal locality generally would have provided resources which may have encouraged Aboriginal occupation in the past. The proposal footprint is located near to the coast which would have also provided abundant resources to encourage past Aboriginal occupation. A review of regional archaeological studies carried out near the proposal footprint identified alluvial areas such as those surrounding Narara Creek are poor preservers of archaeological deposits and artefact scatters are possible in sloping landforms away from the alluvial areas.

A search of the OEH administered AHIMS database on 30 April 2018 returned 29 records for Aboriginal heritage sites within the designated search area (GDA Zone 56, Eastings 343150 - 345850, Northings 6300150 - 6302900 with a buffer of 50 metres). Out of the 29 previously recorded sites returned by the search, none are recorded within the proposal footprint. Two AHIMS sites were identified within the 350 metres of the proposal, comprising:

- AHIMS site 45-3-1370 – A shell midden about 350 metres south west of the southern end of the proposal footprint on the bank of Narara Creek
- AHIMS site 45-3-0561 – The investigation determined that the co-ordinates of the location were most likely an error as the area was observed to be now heavily disturbed and covered with buildings and access roads. The site was most likely associated with another site on a nearby sandstone ridge, also outside the proposal footprint.

The search of the Commonwealth Heritage Listings on 23 May 2018 identified no places listed on either the National or Commonwealth heritage lists within the proposal footprint and the National Native Title Claims Search on 23 May 2018 identified no current native title claims which include the proposal footprint. No Aboriginal places are mapped within the Gosford LEP near the proposal footprint.

A predictive model for Aboriginal archaeological site location was prepared, and based on the environmental context and the regional and local archaeological context, it was identified Aboriginal cultural heritage sites could be recorded across the major landform types found within the proposal footprint; flat, alluvial landforms and sloping, elevated landforms. These sites are likely to be artefact sites with a low artefact density, displaced from their original contexts. The proposal footprint lies within lands traditionally associated with the Darkinjung (also known as Darginung) language group.

Field survey

The field survey did not record any new Aboriginal sites and no landforms within the proposal footprint were assessed as having potential to contain subsurface archaeological deposits. No portions of the proposal footprint were identified as having specific cultural values by the DLALC representatives. A survey of the AHIMS sites located outside the proposal footprint found the following:

- AHIMS site 45-3-1370 – no artefacts were observed during the inspection
- AHIMS site 45-3-0561 –the investigation supported the desktop assumption that the co-ordinates of the location are most likely inaccurate, as the area was observed to be now heavily disturbed and covered with buildings and access roads. The site was most likely associated with another site on a nearby sandstone ridge, also outside the proposal footprint.

6.9.3 Potential impacts

Construction

There is potential to impact previously unrecorded Aboriginal sites during construction while carrying out activities which involve ground disturbance and excavation. However, the proposal site has a low archaeological potential and a low archaeological significance and the proposed work would be contained within areas identified as having high levels of disturbance. The impact assessment has therefore found the proposal would have no impact on known Aboriginal sites, places or areas of potential.

Operation

There are no expected impacts during operation.

6.9.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Unexpected find of an Aboriginal heritage	The <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Roads and Maritime does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work will only re-start once the requirements of that Procedure have been satisfied.	Construction contractor	Construction	Core standard safeguard. Section 4.9 of QA G36 <i>Environment Protection</i> Unexpected Heritage Items (Roads and Maritime, 2015)
	As part of the site induction, all workers will be advised of their obligations in relation to Aboriginal cultural heritage under the National Parks and Wildlife Act 1974 before construction begins and the guidelines to follow if unanticipated heritage items or deposits are located during construction.	Construction contractor	Construction	Additional safeguard
	All site personnel will receive basic training in the recognition of Aboriginal cultural heritage sites and material and have an awareness of the importance of such material and places to both the Aboriginal and non-Aboriginal community.	Construction contractor	Construction	Additional safeguard

6.10 Air quality

6.10.1 Existing environment

Sensitive receivers

Sensitive receivers within one kilometre of the proposal are shown in Section 6.5 and include:

- Residential receivers
- Glenvale School
- St Philip's Christian College
- C3 Church Narara Central Coast
- Narara Neighbourhood Centre
- Central Coast Emergency Accommodation Services for Women.

Ambient air quality

Air quality standards and goals are provided as cumulative values which are made up of the incremental impact from the proposal as well as background concentration levels of pollutants. Therefore, to assess impacts against the relevant air quality standards and goals it is useful to have information on existing air quality pollution levels in the area.

Long term fine particulate matter (PM₁₀) data was obtained from the nearest OEH air quality monitoring station, which is located at Wyong, about 20 kilometres north east of West Gosford. PM₁₀ data recorded at the Wyong monitoring station indicate an average daily concentration of 26.6 µg/m³, which is typical of a semi-rural residential environment with industrial activities. Based on similar types of land use, this data is considered representative of the proposal footprint.

The National Pollutant Inventory holds a database of facilities and emissions to air in the Central Coast region. A search of the National Pollutant Inventory for a two kilometre radius around the proposal identified one reported facility, namely the Kitchens of Sara Lee, located on Railway Crescent north east of the proposal footprint with reported emissions including carbon monoxide, arsenic and compounds, oxides of nitrogen, total volatile organic compounds, sulphur dioxide and zinc.

The primary source of air emissions within immediate proximity of the proposal is expected to be vehicles generating particulate matter and products of combustion. Manns Road carries the majority of existing traffic within the proposal footprint.

Local meteorology

The relative exposure of sensitive receptors to air emissions from a source generally varies dependent on the wind climate, in particular wind direction(s). Poor dispersion for ground based sources is characterised by light winds and stable atmospheres. Wind directions which have these characteristics would have greater risk of air quality impact. Strong winds become important for the construction phase where dust from unconsolidated and stockpiled sources requires mitigation measures to be implemented.

The proposal site is located about two kilometres east of the nearest Bureau of Meteorology Automatic Weather Station at Peats Ridge (Waratah Road). Wind data from this station is considered to be the best available for the site.

The annual and seasonal average wind rose for a thirty year period (1981 to 2011) was assessed and is shown in Figure 6-14 and Figure 6-15 with the following features:

- The predominate morning wind directions are from the north west and south west
- The predominant afternoon wind directions are from the east, north east and north west
- The strongest winds of a morning are from the north west and south west with an average speed of between 5.9 and 7.3 kilometres per hour
- The strongest winds of an afternoon are from the north west with an average speed of between 6.8 and 8 kilometres per hour.

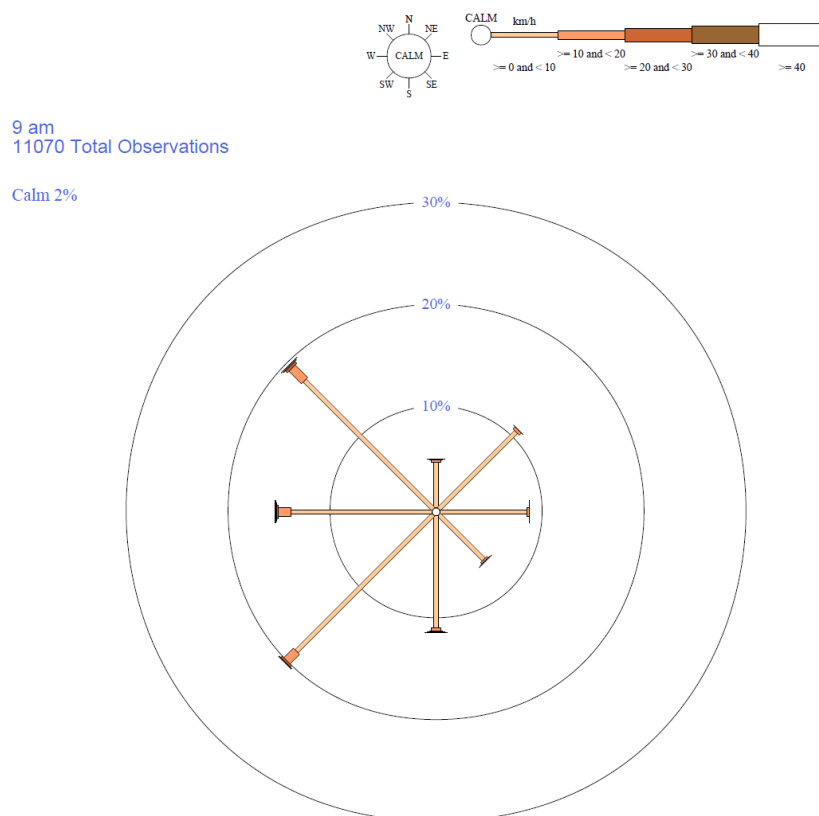


Figure 6-14: 9 am wind direction and strength from Peats Ridge (Waratah Road)

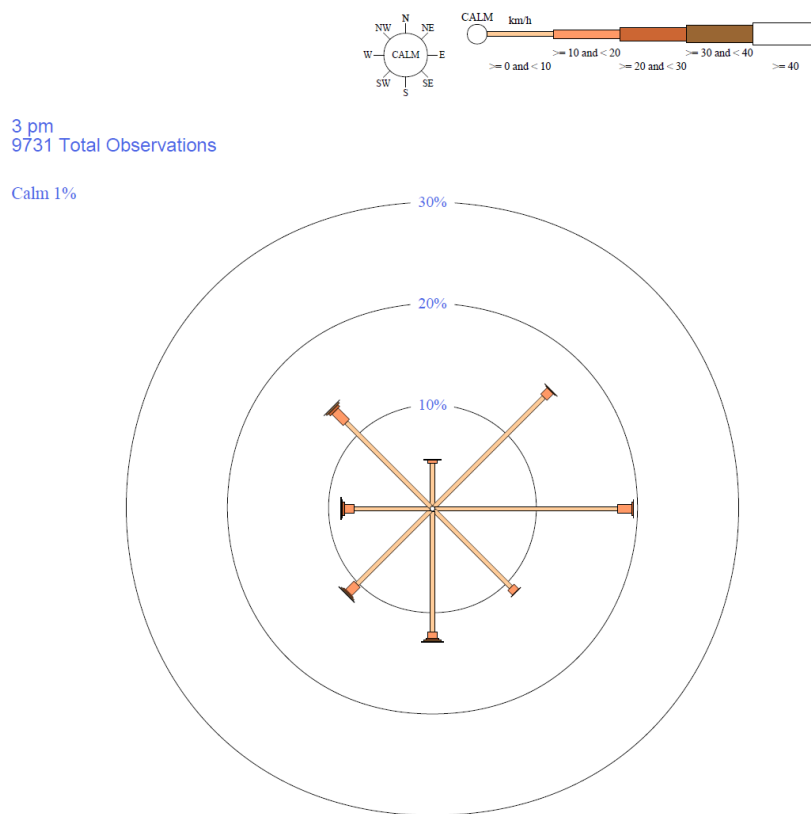


Figure 6-15: 3 pm wind direction and strength from Peats Ridge (Waratah Road)

6.10.2 Potential impacts

Construction

Construction of the proposal may have short-term localised impacts on air quality, primarily due to dust generation. Dust (total suspended particulates, including PM₁₀) would be the primary emission to air generated during the construction of the proposal.

The individual processes which generate dust are:

- Mechanical disturbance - dust emissions brought about by the operation of construction and maintenance vehicles and equipment
- Wind erosion - dust emissions from exposed, disturbed soil surfaces under high wind speeds during construction.

The potential for exposure to dust emissions is dependent on the local weather conditions, intensity of construction work (ie the amount of dust generated and material transfer volumes occurring), duration and frequency of the operations in any given locality and the relative location of nearby sensitive receptors.

Dust emission sources to consider are:

- Material handling during earthwork
- Loading and dumping of material
- Levelling, grading and compacting of disturbed soil surfaces
- Wind erosion of exposed unstable soil surfaces and localised stockpiles.

Sensitive receptors closest to the construction work area have the highest potential for adverse air quality impacts, particularly the residences located very close to the proposal on the east of Manns Road on the southbound approach to the intersection and the schools on either side of Narara Creek Road. Dust emissions during construction are typically sufficiently managed through the application of mitigation measures. Dust management measures have been outlined in Section 6.10.3 to assist in minimising off-site impacts during the construction phase of the proposal.

Vehicle exhaust emissions during the construction phase have the potential to impact on air quality, although the number of construction vehicles and equipment would be insignificant compared with the existing traffic numbers on Manns Road (11,000 to 18,000 per day). All construction and administrative vehicles are expected to be maintained in a serviceable condition so exhaust emissions are reduced to manufacturer specified levels.

Operation

The proposal would reduce congestion, and in turn, decrease the time vehicles are idling at the intersection. This would reduce vehicle emissions in the localised area of the proposal footprint.

6.10.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
General air quality impacts	<p>An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to:</p> <ul style="list-style-type: none"> • Potential sources of air pollution • Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines • Mitigation and suppression measures to be implemented • Methods to manage work during strong winds or other adverse weather conditions • A progressive rehabilitation strategy for exposed surfaces. 	Construction contractor	Construction	Core standard safeguard
Dust emissions	Dust suppression measures will be implemented in accordance with the CEMP. This would include watering down the site, covering trucks when transporting dust generating material and covering, placing and managing stockpiles in accordance with <i>Stockpile Management Guideline</i> (RTA, 2011b).	Construction contractor	Construction	Additional safeguard
Exhaust emissions	Construction plant and equipment will be maintained in a good working condition in order to limit impacts on air quality and plant and machinery will be turned off when not in use.	Construction contractor	Construction	Additional safeguard
Impacts on sensitive receivers	Local residents will be advised of hours of operation and duration of work and supplied with a contact name and number for queries regarding air quality.	Construction contractor	Construction	Additional safeguard

6.11 Other impacts

The existing environment, potential impacts and associated safeguards and management measures for environmental factors with negligible to minor impacts is provided in Section 6.11.2 and 7.2.

6.11.1 Existing environment and potential impacts

Environmental factor	Existing environment	Potential impacts
Non-Aboriginal heritage	<p>A preliminary historical heritage assessment was conducted for the proposal by Virtus Heritage which included database searches and a site inspection. Historical heritage database searches did not identify any historical or Indigenous heritage places within the proposal footprint.</p> <p>The proposal locality was once significant for timber retrieval and the railway industry, with timber felling and sawmills comprising significant industries throughout the nineteenth century. The heritage assessment determined no historical heritage items or potential works or relics were identified in the proposal footprint.</p>	<p>No known historical heritage items or places would be impacted by construction of the proposal. During construction the proposal does have the potential to impact any unidentified relics or areas of predicted occupation deposit within the proposal footprint, however given the extent of development in the area the risk of this is very low.</p> <p>The proposal footprint is mostly urbanised development with no original uncompromised views in the landscape due to recent twentieth century housing and development. The proposal would not impact any historical views or settings to heritage items in the broader landscape, as these views are compromised heavily already.</p> <p>There would be no operation impacts to non-Aboriginal heritage as a result of the proposal.</p>

Environmental factor	Existing environment	Potential impacts
Groundwater	<p>Groundwater was assessed through desktop review and geotechnical investigations comprising six test pits (TP48, TP51 – TP55) and five boreholes (BH15 – BH20) at the locations shown in Figure 6-11, in Section 6.4.</p> <p>Based on the bore usage information reviewed as part of the groundwater bore search, it is possible groundwater within the area could be used for either drinking water, recreational, irrigation or stock watering purposes.</p> <p>Site investigations found the proposal is located in topographically high areas where bedrock is located at or near the surface, with groundwater generally not encountered during investigations. Groundwater was detected in one borehole only (BH16), where it ranged between six to eight metres below existing ground level.</p>	<p>The depth of excavation for the road alignment during construction is anticipated to be about two metres below existing ground level. Therefore, excavation is not expected to intersect with groundwater given groundwater levels ranged between six and eight metres below ground level within the proposal footprint.</p> <p>There are no expected impacts on groundwater from operation of the proposal.</p>
Waste and resource use	<p>The proposal footprint is currently comprised of the existing Manns Road, with grassed road verge and footpaths near residential dwellings. With the exception of those generated within the private properties alongside Manns Road, the proposal footprint is not currently subject to any waste generating activities.</p>	<p>Construction</p> <p>Construction of the proposal would require the use of a number of resources, including:</p> <ul style="list-style-type: none"> Resources associated with the operation of construction machinery and motor vehicles (for example use of diesel and petrol) Material required for road surface and pavements (road base, asphalt, spray seal, sand, concrete and aggregate) Fill required to meet design levels Materials required for road signage and traffic signals Construction water (for example for concrete mixing and dust suppression). <p>The materials required for construction of the proposal are not currently limited in availability. However, materials such as metal and fuel are non-renewable and would be used conservatively.</p> <p>The proposal has the potential to generate waste from the following activities:</p> <ul style="list-style-type: none"> Vegetation to be removed as part of the proposal

Environmental factor	Existing environment	Potential impacts
		<ul style="list-style-type: none"> • Earthwork • Utility adjustments • Waste from the removal of the existing road alignment. <p>Waste streams likely to be generated during construction of the proposal include:</p> <ul style="list-style-type: none"> • Excess spoil • Green waste as a result of vegetation clearing • Roadside materials (for example fencing, guard posts, guard rails) • Packaging and general waste from staff (for example lunch packaging, portable toilets) • Chemicals and oils • Waste water from wash-down and bunded areas • Excess concrete • Redundant erosion and sediment controls. <p>The potential to reuse materials would be investigated during detailed design. Unsuitable fill material which cannot be used on site would be classified in accordance with the EPA's Waste Classification Guidelines (2014) and disposed of at an approved materials recycling or waste disposal facility.</p> <p>Operation</p> <p>The proposal would not result in an impact to waste generation or resource use.</p>

Environmental factor	Existing environment	Potential impacts
Utilities	<p>Preliminary investigations have indicated the following existing utilities and corresponding authorities are within the extents of the proposal:</p> <ul style="list-style-type: none"> • Overhead and underground electricity – Ausgrid • Water reticulation – Central Coast Council • Sewer reticulation – Central Coast Council • Telecommunications – Telstra /NBN, NextGEN, Optus, TPG Communications • Gas reticulation (high and medium pressure) – Jemena. 	<p>Construction Construction activities have the potential to impact on existing utilities and services, in particular underground services such as electricity, gas, and telecommunications. Accidental strike of any of these utilities could result in spills, pollution, injury to workers, damage to infrastructure and/or disruption to businesses and nearby residents as a result of the temporary disconnection of services.</p> <p>Roads and Maritime would further consult with relevant service providers during detailed design to identify possible interactions and develop procedures to be implemented to minimise the potential for service interruptions which have the potential to impact on existing land use.</p> <p>Operation No impact to utilities is anticipated during operation of the proposal as utilities will be relocated away from the proposed design, or appropriately protected.</p>

Environmental factor	Existing environment	Potential impacts
Hazard and risk management	Existing hazards and risks in the proposal footprint are generally associated with operation of the road network.	<p>Construction</p> <p>Potential hazards and spills associated within construction include:</p> <ul style="list-style-type: none"> • Spills or leakage of contaminants such as fuels, chemicals and hazardous substances entering surface and groundwater or contaminating soils • Discharge of turbid run-off, resulting in pollution of waterways • Encountering utilities or contaminated material during earthwork (for example, asbestos) • Flood of the area during extreme rain events • Changes to traffic conditions resulting in traffic incidents. <p>These potential impacts have been addressed in other sections of this REF. Construction risks would be temporary and appropriately managed with the relevant safeguards provided in the relevant sections. Hazards and risk to the local area would be localised and limited to areas immediately adjacent to the proposal site.</p> <p>Operation</p> <p>Operational hazards and risks relating to the proposal could include:</p> <ul style="list-style-type: none"> • Fuel and oil spills during maintenance activities polluting the natural environment • Vehicle incidents. <p>Vehicle crashes are an inherent aspect of the operation of any road. The proposed upgrade of Manns Road would improve the safety of road users and subsequently reduce the risk of vehicle crashes at the proposal site.</p>

Environmental factor	Existing environment	Potential impacts
Energy and greenhouse gas	<p>The Commonwealth Department of the Environment estimates annual greenhouse gas emissions for Australia. Australian and NSW total greenhouse gas emissions for 2016 were estimated as 524.0 and 131.6 metric tonnes of carbon dioxide equivalent, respectively.</p> <p>The major emission sources for NSW were fuel combustion for stationary energy purposes and fuel combustion for transport purposes. The Australian Government has agreed to reduce emissions in Australia by 26-28 per cent below 2005 levels by 2030.</p> <p>Key Commonwealth legislation relevant to the proposal includes:</p> <ul style="list-style-type: none"> • National Greenhouse and Energy Reporting Act 2007 • Carbon Credits (Carbon Farming Initiative) Act 2011. <p>The implications of the above legislation would be assessed during detailed design when the resource extraction schedule has been determined.</p>	<p>Construction</p> <p>Key sources of greenhouse gas emissions associated with the construction of the proposal would include:</p> <ul style="list-style-type: none"> • Vegetation removal, resulting in release of stored carbon dioxide to the atmosphere • Operation of construction equipment, resulting in release of fugitive carbon dioxide and nitrous oxide emissions from fuel (petrol, diesel) • Possible fugitive methane emissions from the use of natural gas for operating construction equipment • Use of materials that require a large amount of energy to create, such as concrete • Landfilling and carbon-based waste, resulting in emissions of methane • On-site electricity use. <p>It is anticipated construction equipment, concrete production and vehicles would be the main emission source during construction. The amount of greenhouse gas emissions associated with the construction of the proposal would be heavily dependent on the quantity of bulk earthwork required as well as the extent of vegetation removal, which are both expected to be negligible and therefore a significant impact is not anticipated.</p> <p>Operation</p> <p>The primary source of greenhouse gas emissions during operation would be associated with vehicles using Manns Road. As the traffic volume is not predicted to increase as a result of the proposal, the amount of exhaust emissions emitted is not expected to increase. Other greenhouse gas emission sources likely to be associated with the operational phase of the proposal include maintenance activities and any electricity used for lighting and/or signals.</p>

6.11.2 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage	The <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered. Work will only restart once the requirements of that Procedure have been satisfied.	Construction contractor	Construction	Core standard safeguard Section 4.10 of QA G36 <i>Environment Protection</i>
	An awareness package would be prepared as part of the site induction, informing all personnel of their responsibilities under the provisions of the National Parks and Wildlife Act, 1974 (including the penalties under the ancillary provisions) and NSW Heritage Act 1977. This induction should also include an outline of the Roads and Maritime Procedures for Unexpected Finds and the requirement to stop work immediately until this process is followed and these responsibilities are met.	Construction contractor	Construction	Additional safeguard
Groundwater	In the event dewatering of disturbed areas of the site is required, it would need to be carried out in accordance with the <i>Roads and Maritime Technical Guideline for dewatering</i> .	Construction contractor	Construction	Additional safeguard <i>Roads and Maritime Technical Guideline for dewatering</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Waste	<p>A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to:</p> <ul style="list-style-type: none"> Measures to avoid and minimise waste associated with the proposal Classification of wastes and management options (re-use, recycle, stockpile, disposal) Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions Procedures for storage, transport and disposal Monitoring, record keeping and reporting. <p>The WMP will be prepared taking into account the <i>Environmental Procedure - Management of Wastes on Roads and Maritime Services Land</i> (Roads and Maritime, 2014) and relevant Roads and Maritime Waste Fact Sheets.</p>	Construction contractor	Construction	<p>Core standard safeguard</p> <p>Section 4.2 of QA G36 <i>Environment Protection</i></p> <p><i>Environmental Procedure - Management of Wastes on Roads and Maritime Services Land</i> (Roads and Maritime, 2014)</p>
	<p>The following resource management hierarchy principles will be followed:</p> <ul style="list-style-type: none"> Avoid unnecessary resource consumption as a priority Avoidance will be followed by resource recovery (including reuse of materials, reprocessing, and recycling and energy recovery) Disposal will be a last resort (in accordance with the <i>Waste Avoidance and Resource Recovery Act 2001</i>). 	Construction contractor	Construction	<p>Additional safeguard</p> <p><i>Waste Avoidance and Resource Recovery Act 2001</i></p>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Utilities	<p>Prior to the start of work:</p> <ul style="list-style-type: none"> The location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners If the scope or location of proposed utility relocation work falls outside of the assessed proposal scope and footprint, further assessment will be conducted. 	Construction contractor	Construction	Core standard safeguard
	Roads and Maritime would consult with relevant service providers during detailed design to identify possible interactions and develop procedures to be implemented to minimise the potential for service interruptions which have the potential to impact on existing land use.	Roads and Maritime	Detailed design	Additional safeguard
Hazards and risk management	<p>A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to:</p> <ul style="list-style-type: none"> Details of hazards and risks associated with the activity Measures to be implemented during construction to minimise these risks Record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials A monitoring program to assess performance in managing the identified risks Contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations. <p>The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or Office of Environment and Heritage publications.</p>	Construction contractor	Construction	Core standard safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Demand on resources	<p>Procurement and planning of construction will incorporate the following strategies:</p> <ul style="list-style-type: none"> • Procurement would endeavour to use materials and products with a recycled content where that material or product is cost and performance effective • Excavated material would be reused on-site for fill where feasible to reduce demand on resources. • Any additional fill material required would be sourced from appropriate local sources and/or other Roads and Maritime projects. 	Construction contractor	Construction	Additional safeguard
Energy efficiency	<p>Vehicles, plant and equipment would be selected and managed according to the following:</p> <ul style="list-style-type: none"> • The selection process for vehicle and plant would consider energy efficiency and related carbon emissions • Equipment will be serviced frequently to ensure it is operating efficiently • Machinery will be operated efficiently to ensure optimal performance, minimise downtime and improve fuel efficiency. 	Construction contractor	Construction	Additional safeguard

6.12 Cumulative impacts

Cumulative impacts have the potential to arise from the interaction of individual elements within the proposal and the additive effects of other external projects. Roads and Maritime is required under Clause 228 (2) of the EP&A Act, to take into account potential cumulative impacts as a result of the proposal.

This section describes the cumulative impacts and benefits likely to arise from the combination of the construction and operation of the proposal with other projects being carried out in the area. No specific projects or developments are known to be planned within one to two kilometres of the proposal and therefore this section focuses on the cumulative impact of the broader program of work. There are some new developments proposed in the industrial area to the south of the proposal, but significant cumulative impacts with these projects are not anticipated.

6.12.1 Broader program of work

The proposal is part of a broader program of work to upgrade the Pacific Highway between the M1 Pacific Motorway and the Central Coast Highway (Figure 1-2). The works are being conducted over five stages as shown in Section 2.2.5 and includes:

- Stage 1 and 2 between the M1 Pacific Motorway and Ourimbah
- Stage 3 from Ourimbah to Lisarow
- Stage 4 from Lisarow to Narara
- Stage 5 from Narara to West Gosford, near the interchange with Central Coast Highway (subject to this REF).

Construction of these stages over a long duration across the Manns Road corridor between the M1 Pacific Motorway and the Central Coast Highway could result in long term impacts associated with increased travel time and a reduction in the level of community participation throughout the road corridor due to community members avoiding this route. However, the Stage 1 to 4 works are all located to the north of the proposal, and have already been finished, are in construction or in planning and are not anticipated to be conducted concurrent to the proposal.

The Stage 5, Narara to West Gosford planning covers:

- This proposal at the Narara Creek Road intersection
- Another nearby proposal to upgrade Manns Road at the southbound approach to the Stockyard Place intersection
- Remaining upgrades in Stage 5, between Stockyard Place (northbound lanes) and about 300 metres south of Narara Creek Road/Maliwa Road intersection, currently only in planning and with no detailed proposals.

6.12.2 Potential impacts

It is not expected there would be significant cumulative impacts associated with the proposal and the potential construction of other projects in the area. The proposal would be conducted prior to and separately from any other potential proposals in the remaining Stage 5 work between Stockyard Place (northbound lanes) and about 300 metres south of Narara Creek Road/Maliwa Road intersection. In addition, none of these potential proposals have been planned or confirmed at this time and will require further development and approvals.

It is also uncertain whether the proposal and another nearby section of the Manns Road upgrade – southbound approach to Stockyard intersection, would be constructed at the same time, or consecutively. If these happen to be constructed at the same time, it is unlikely there would be substantial overlapping impacts to traffic, sensitive receptors or property and business access as they are located about two kilometres away from each other.

Potential short-term and local amenity impacts may arise if the construction of other projects occur simultaneously with the proposal, although cumulative impacts would be minimised through the application of proposal specific environmental safeguards and management measures as summarised in Section 6.12.3. Consultation with the relevant stakeholders would be carried out during construction planning to ensure potential cumulative impacts are minimised. Any additional mitigation measures from the consultation would be included in relevant construction management plans for the proposal. Potential cumulative impacts which could occur in relation to the proposal are provided in Table 6-24.

Table 6-24: Potential cumulative impacts

Environmental factor	Construction	Operation
Traffic	<p>If other projects (such as other stages/phases of the road upgrade) were constructed concurrently with the proposal, there is a potential for traffic to be increased due to additional heavy and light vehicles and machinery required to deliver plant, equipment and personnel to the relevant project sites. This would result in increased traffic delays due to additional road construction/ diversions or as a result of increased traffic causing congestion.</p> <p>Cumulative traffic impacts would only occur during construction, which is of relatively short duration (up to 18 months).</p>	<p>Upgrade of the Narara Creek Road intersection would improve the flow of traffic and provide improved pedestrian and cycle facilities in the proposal footprint. As such, the proposal would reduce cumulative impacts of other projects during operation.</p> <p>Adjoining road upgrades would also result in a broader improvement in travel times and reduce congestion, increasing the positive cumulative impact for the area.</p>
Air quality	<p>Air quality would decrease during construction of the proposal and other projects if dust levels are exceeded. The proposal would implement mitigation measures to ameliorate impacts caused by dust.</p>	<p>Longer term changes to air quality would be negligible during the operation of the proposal and therefore cumulative impacts with other projects are not anticipated.</p>
Noise	<p>Residents of Manns Road and surrounds would experience increased noise levels for the duration of construction of the proposal.</p> <p>If the construction of other stages and proposals directly north and to the south at Stockyard Place occurred concurrently, background noise levels may slightly increase further, although they are located relatively far from each other so cumulative noise impacts are not anticipated.</p>	<p>The proposal is not anticipated to cause an increase in noise levels. Noise assessment of this proposal has already taken account of the cumulative increases in noise from the current situation.</p> <p>As most of these nearby proposal and stages are still in planning, noise assessment would be required as part of the approval and this would account for any changes from this proposal.</p>

Environmental factor	Construction	Operation
Socio-economic	The proposal may temporarily reduce amenity in the area during construction as a result of air, noise, traffic and visual impacts. However, this would be short-term.	Operation of the proposal would increase connectivity and decrease traffic wait times for residents of Narara and surrounds, increasing satisfaction of road users including residents. Adjoining road upgrades would increase this positive cumulative impact, resulting in a greater improvement in travel times and the community's perception of the amenity, safety and accessibility of Manns Road.

6.12.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Cumulative impacts	The construction environmental management plan would consider potential cumulative construction impacts from surrounding development activities, such as noise and dust, as they become known.	Contractor	Construction	Additional safeguard
	Ongoing coordination and consultation would be carried out with other proponents to ensure potential cumulative impacts are appropriately assessed and managed.	Roads and Maritime	Detailed design	Additional safeguard

7. Environmental management

7.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Project Environmental Management Plan (PEMP) and a Construction Environmental Management Plan (CEMP) will be prepared to describe the safeguards and management measures identified. The PEMP and CEMP will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

The PEMP and CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the Roads and Maritime Environment Officer, Central Coast, prior to the start of any on-site work. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP and PEMP would be developed in accordance with the specifications set out in the [adjust as necessary: QA Specification G36 – *Environmental Protection (Management System)*, QA Specification G38 – *Soil and Water Management (Soil and Water Plan)*, QA Specification G40 – *Clearing and Grubbing*, QA Specification G10 – *Traffic Management*.

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF will be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed work on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.

Table 7-1: Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
GEN 1	General - minimise environmental impacts during construction	<p>A CEMP will be prepared and submitted for review and endorsement of the Roads and Maritime Environment Manager prior to start of the activity.</p> <p>As a minimum, the CEMP will address the following:</p> <ul style="list-style-type: none"> Any requirements associated with statutory approvals Details of how the proposal will implement the identified safeguards outlined in the REF Issue-specific environmental management plans Roles and responsibilities Communication requirements Induction and training requirements Procedures for monitoring and evaluating environmental performance, and for corrective action Reporting requirements and record-keeping Procedures for emergency and incident management Procedures for audit and review. <p>The endorsed CEMP will be implemented during the undertaking of the activity.</p>	Construction contractor	Construction	Core standard safeguard
GEN 2	General – notification	All businesses, residential properties and other key stakeholders (for example schools, local councils) affected by the activity will be notified at least five business days prior to start of the activity.	Construction contractor	Construction	Core standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
GEN 3	General – environmental awareness	<p>All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular ‘toolbox’ style briefings.</p> <p>Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include:</p> <ul style="list-style-type: none"> • Location of vulnerable flora within Compound 1 • Adjoining residential areas and community facilities requiring particular noise management measures. 	Construction contractor	Construction	Core standard safeguard
N&V 1	Construction noise and vibration management	<p>A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in the Interim Construction Noise Guideline (DECC, 2009) and identify:</p> <ul style="list-style-type: none"> • All potential significant noise and vibration generating activities associated with the activity • Feasible and reasonable mitigation measures to be implemented, taking into account <i>Beyond the Pavement: urban design policy, process and principles</i> (Roads and Maritime, 2014) • A monitoring program to assess performance against relevant noise and vibration criteria • Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria. 	Construction contractor	Construction	<p>Core standard safeguard</p> <p>Section 4.6 of QA G36 <i>Environment Protection</i></p> <p><i>Interim Construction Noise Guideline</i> (DECC, 2009)</p> <p><i>Beyond the Pavement: urban design policy, process and principles</i> (Roads and Maritime, 2014)</p>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
N&V 2		<p>Include measures in the NVMP to shield sensitive receivers from noise, including:</p> <ul style="list-style-type: none"> • Placement and layout of construction compounds to locate primary noise sources away from sensitive receivers • Use solid structures (sheds, containers, etc.) as shields for sensitive receivers • Enclosure fixed noise sources such as pumps, compressors, fans, screens (where practicable). 	Construction contractor	Construction	Additional safeguard
N&V 3		The NVMP would include additional noise mitigation measures to be implemented when exceedances of construction noise management levels remain after the implementation of standard noise mitigation measures, which will be implemented where reasonable and feasible. Guidance on suggested additional noise mitigation measures for each receiver are provided in the specialist noise report attached to this REF.	Construction contractor	Construction	Additional safeguard
N&V 4		Include a complaints procedure in the NVMP to address complaints and corrective actions. This should include the requirement to undertake noise monitoring if applicable.	Construction contractor	Construction	Additional safeguard
N&V 5		<p>All sensitive receivers (for example schools, local residents) likely to be affected will be notified at least five calendar days prior to the start of any work associated with the activity which may have an adverse noise or vibration impact. The notification will provide details of:</p> <ul style="list-style-type: none"> • The proposal • The construction period and construction hours • Contact information for project management staff • Complaint and incident reporting <p>How to obtain further information.</p>	Construction contractor	Construction	Core standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
N&V 6		<p>An out-of-hours work procedure for assessing and managing activities requiring work outside of standard hours will be developed and would include the following:</p> <ul style="list-style-type: none"> • Five working days prior to the activity starting, contact the receivers from the local community which are potentially affected by the proposed work and inform them by letter of the proposed work, location, type of work, days and dates of work and hours involved • A 24-hour community liaison phone number and permanent site contact will be provided so complaints can be received and addressed in a timely manner <p>Measures to investigate and respond to any valid noise complaints.</p>	Construction contractor	Construction	Additional safeguard
N&V 7	Construction vibration impacts	Building condition surveys will be carried out at receivers (as required) within 50 metres of proposed vibration generating activities (buildings and other structures).	Construction contractor	Construction	Additional safeguard
N&V 8		Where construction activities are scheduled to use vibration generating equipment, and there are occupied buildings within the relevant buffer distances specified in Table 5-27 of the Manns Road upgrade – Narara Creek Road Intersection Noise and Vibration Assessment, a notification to the affected properties would occur prior to the start of the construction activity.	Construction contractor	Construction	Additional safeguard
N&V 9		Develop a monitoring plan in the NVMP that covers potential high vibration activities including work within 13 metres of sensitive receivers. The plan would include trial monitoring to determine actual vibration levels likely from the activity and a procedure for dealing with exceedances of the vibration criteria, which would include ceasing activities and investigation of alternative work methods	Construction contractor	Construction	Additional safeguard
N&V 10	Construction noise impacts - machinery	Where practical, construction equipment and machines will be selected to minimise noise emissions, fitted with appropriate silencers and be maintained in good working order.	Construction contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
N&V 11	Operational noise impact	<p>An operational noise assessment would be undertaken during detailed design to further assess the need for reasonable and feasible noise mitigation measures for qualifying receivers outlined in the REF. The assessment would;</p> <ul style="list-style-type: none"> Identify the types of noise treatment required at each receiver to reduce noise levels to the required criteria Include facade testing for places of worship and educational premises to identify internal noise level reductions Consider options for quieter pavement surfaces to reduce noise levels to the required criteria. 	Roads and Maritime	Detailed design	Additional safeguard
N&V 12		<ul style="list-style-type: none"> Conduct post construction noise monitoring and assessment (including simultaneous counts) within 12 months of opening once traffic flows have stabilised. Monitoring locations should be at the same locations undertaken in this assessment and at locations where any noise complaints are received. 	Roads and Maritime	Post-construction	Additional safeguard Section 6 of <i>Road and Maritime's Noise Model Validation Guideline</i>
BIO1	Environmental management	<p>A Flora and Fauna Management Plan will be prepared in accordance with Roads and Maritime's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> (Roads and Traffic Authority, 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and trees and permanent and temporary revegetation areas Requirements set out in the <i>Landscape Guideline</i> (Roads and Traffic Authority, 2008) Pre-clearing survey requirements Procedures for unexpected threatened species finds and fauna handling Procedures addressing relevant matters specified in the <i>Policy and guidelines for fish habitat conservation and management</i> (DPI Fisheries, 2013) Protocols to manage weeds and pathogens. 	Construction Contractor	Construction	Core standard safeguard <i>Section 4.8 of QA G36 Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
BIO2	Habitat loss	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Detailed designer	Detailed design	Core standard safeguard
BIO3		The PCT 1723 <i>Melaleuca biconvexa</i> - Swamp Mahogany - Cabbage Palm swamp forest of the Central Coast in the proposal footprint at Compound site #1 should be excised from any lease or other land-use agreement and an exclusion zone implemented around the edge of the community with suitable barricades in accordance with <i>Guide 2: exclusion Zones, Biodiversity Guidelines</i> (Roads and Traffic Authority, 2011).	Construction Contractor	Construction	Additional safeguard <i>This safeguard only applies if Compound site #1 is selected for use by construction contractor</i>
BIO4	Pre-clearance surveys	<p>A pre-clearance procedure will be developed in the Flora and Fauna Management Plan and implemented in accordance with the Roads and Maritime Biodiversity Guidelines.</p> <p>Pre-clearance surveys will be carried out by a qualified ecologist and the required methodology will be developed for target species as part of the as part of the Flora and Fauna Management Plan.</p> <p>Surveys would include:</p> <ul style="list-style-type: none"> • Inspection of any tree hollows for roosting fauna including microbats prior to removal • Recommendations for staged clearing in areas of native vegetation to allow any possible fauna present to migrate out of the construction zone • Marking of any habitat trees and features for specialist removal or removal under the supervision of the fauna specialist. <p>Fauna handling will be conducted in accordance with the Roads and Maritime Biodiversity Guidelines. Any unexpected threatened species finds will be managed in accordance with the Roads and Maritime <i>Biodiversity Guidelines</i>.</p>	Construction contractor	Construction	<p>Additional safeguard</p> <p>Roads and Maritime Biodiversity Guidelines (<i>Guide 1: Pre-clearing process</i>) (RTA 2011)</p> <p>Roads and Maritime Biodiversity Guidelines (<i>Guide 9: Fauna handling</i>) (RTA 2011)</p>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
BIO5	Worker inductions	Ensure all workers are made aware of key flora and fauna management requirements, through a site environmental induction, prior to starting construction activities on site. This should include, but is not limited to, information on the ecological values of the site and details of protection measures to protect biodiversity during construction, including sensitive area and exclusion zone fencing and signage and procedures for dealing with injured fauna.	Contractor	Construction	Additional safeguard
BIO6	Weed removal and spread	Protocols for preventing or minimising the spread of priority and environmental weeds will be developed and implemented in accordance with the <i>Roads and Maritime Biodiversity Guidelines (Guide 6: Weed Management)</i> (RTA 2011).	Construction contractor	Construction	Additional safeguard <i>Roads and Maritime Biodiversity Guidelines (Guide 6: Weed Management)</i> (RTA 2011).
BIO7	Weed invasion and edge effects	Ongoing weed management and control in accordance with the Roads and Maritime Biodiversity Guidelines (Roads and Traffic Authority, 2011).	Roads and Maritime	Operation	Additional safeguard <i>Roads and Maritime Biodiversity Guidelines</i> (Roads and Traffic Authority, 2011).
BIO8	Connectivity and fauna habitat fragmentation	Once final design and construction areas have been confirmed for the southern parts of the proposal footprint, the need for mitigation measures for maintaining connectivity of gliding species across Manns Road would be further assessed and investigated during detailed design. This assessment would be documented in a design report. Connectivity measures will be implemented in accordance with the <i>Wildlife connectivity Guidelines for Road Projects</i> (RTA, 2011b).	Construction contractor	Construction	Additional safeguard <i>Wildlife connectivity Guidelines for Road Projects</i> (RTA, 2011b)

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
BIO9	Vegetation rehabilitation	<p>Native vegetation will be re-established following disturbance, where it does not obstruct road maintenance or affect road safety, in accordance with <i>Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011b).</p> <p>This includes undertaking restoration activities in areas of PCT 1579 Smooth-barked Apple – Turpentine – Blackbutt open forest, where disturbed by construction, using species of local provenance.</p>	Construction contractor	Construction	<p>Additional safeguard</p> <p><i>Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011b).</p>
SOC 1	General construction impacts	<p>A Communication Plan will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The Communication Plan will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008) and include (as a minimum):</p> <ul style="list-style-type: none"> • Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions • Contact name and number for enquiries and complaints. <p>The Communication Plan will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008).</p>	Construction Contractor	Construction	<p>Standard core safeguard</p> <p><i>Community Involvement and Communications Resource Manual</i> (RTA, 2008)</p>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SOC 2		<p>Additional aspects to be considered in the Communication Plan would comprise:</p> <ul style="list-style-type: none"> • Communication with the community with timely and relevant information to enable them to understand the likely nature, extent and duration of vibration, dust, noise and utility impacts and access changes • Targeted communication strategies will be prepared and implemented for key stakeholders to discuss potential noise impacts during construction and operation, potential privacy concerns and availability of safe pedestrian and vehicle access. Specific stakeholders to be covered include: <ul style="list-style-type: none"> – General community and local residents – Glenvale School – St Philip's Christian College – Central Coast Emergency Accommodation Services for Women – Local sporting clubs at Gavenlock Oval – Local health/support services – Vulnerable (for example older people, people with a disability) households – Related assisted transport providers. <p>Communication will include roadside signage, letterbox dropped newsletters, newspaper advertisements, construction hoarding or project signs including contact details, Roads and Maritime web based information and project enquiries line.</p>	Construction Contractor	Construction	Additional safeguard
SOC 3	Traffic delays	A detailed traffic management plan would be prepared. The plan would provide details of the traffic management to be implemented during construction to ensure traffic flow on the surrounding network is maintained where possible. Consultation with Council would be conducted during preparation of the traffic management plan.	Construction contractor	Pre-construction and construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SOC 4	Altered access	Construct suitable temporary alternative accesses (either via diversion or altered access provisions) during construction and reinstate driveways for properties impacted by the design.	Construction Contractor	Construction	Additional safeguard
SOC 5		Provide safe alternative pedestrian access to designated crossing points on Manns Road and all community facilities, schools and local properties at all times during construction. Supply signage for pedestrians to road crossings, schools and properties as required.	Construction Contractor	Construction	Additional safeguard
SOC 6	Altered access to left in/ left out only	Engage with the C3 Church and residents affected by the left-in, left-out only as a result of the central median and discuss alternative routes and access.	Roads and Maritime	Detailed design	Additional safeguard
SOC 7	Property impacts	Carry out targeted consultation with property owners regarding potential strip acquisition and use of the privately owned site for Compound 1. Existing features impacted by the temporary occupation would be reinstated or replaced if damaged following agreement with the property owner.	Roads and Maritime	Detailed design	Additional safeguard
SOC 8	Parking impacts	Construction personnel/vehicle parking would be provided in construction compounds. All construction personnel will be informed that parking should be within the compounds or work sites, and to avoid parking on local roads.	Construction contractor	Construction	Additional safeguard
SOC 9	Public transport	Engage with Glenvale School, St Philip's Christian College and the bus provider during detailed design regarding the potential removal of the bus stop on Manns Road to understand the use and ensure that alternative routes can be maintained in the short and long term. The complex needs of students who attend students from Glenvale School would be considered.	Roads and Maritime	Detailed design	Additional safeguard
SOC 10		Provide advance warning of the potential removal of the bus stop and advertise alternative routes to the nearby stops during and following construction.	Roads and Maritime	Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
L&V 1	Landscape character and visual impact	<p>An Urban Design Plan will be prepared to support the final detailed proposal design and implemented as part of the CEMP.</p> <p>The Urban Design Plan will present an integrated urban design for the proposal, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The Plan will include design treatments for:</p> <ul style="list-style-type: none"> • Location and identification of existing vegetation and proposed landscaped areas, including species to be used • Built elements including retaining / rock-bolt walls • Pedestrian and cyclist elements including footpath location, paving types and pedestrian crossings • Fixtures such as seating, lighting, fencing and signs • Details of the staging of landscape work taking account of related environmental controls such as erosion and sedimentation controls and drainage • Procedures for monitoring and maintaining landscaped or rehabilitated areas. <p>The Urban Design Plan will be prepared in accordance with relevant guidelines, including:</p> <ul style="list-style-type: none"> • Beyond the Pavement urban design policy, process and principles (Roads and Maritime, 2014) • Landscape Guideline (RTA, 2008) • Bridge Aesthetics (Roads and Maritime 2012) • Shotcrete Design Guideline (RTA, 2016) <p>The Urban Design Plan would also take this environmental assessment and the urban design principles.</p>	Detailed designer	Detailed design	<p>Standard core safeguard</p> <p>Beyond the Pavement urban design policy, process and principles (Roads and Maritime, 2014)</p> <p><i>Landscape Guideline</i> (RTA, 2008)</p> <p>Bridge Aesthetics (Roads and Maritime 2012)</p> <p>Shotcrete Design Guideline (RTA, 2005)</p>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
L&V 2	Visual impacts	Develop a limited range of materials, colours and textures for all built elements to achieve a simple uncluttered design. The types of materials proposed are to reflect the locality and be appropriate for its intended application.	Detailed designer	Detailed design	Additional safeguard
L&V 3		<p>The Urban Design Plan would take the following visual aspects into consideration:</p> <ul style="list-style-type: none"> • Protect views to the local hills and surrounding vegetation • Include provision of shade and weather protection through the use of trees, vegetation and bus shelters • Medians, street lighting, pedestrian fences and walls would incorporate a simple, consistent design including the use of a limited range of materials, colours and textures • Minimise work on adjacent properties and opportunities for incorporation of design treatments would be reviewed pending any property acquisitions. 	Detailed designer	Detailed design	Additional safeguard
L&V 4		Compounds, storage areas, stockpiles and associated work areas will be located in cleared or disturbed areas as far as possible.	Construction contractor	Construction	Additional safeguard
L&V 5		The construction site will be kept tidy and rubbish free.	Construction contractor	Construction	Additional safeguard
L&V 6		The site will be rehabilitated and landscaped with consideration of constraints within the corridor and in accordance with an approved landscape plan.	Construction contractor	Construction	Additional safeguard
L&V 7	Vegetation removal	Existing vegetation will be maintained and protected wherever possible. Trimming of trees rather than clearing will be carried out where possible.	Construction contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
L&V 8	Light spill	Temporary lighting for construction will be sited and designed to minimise light spill into residential properties and identified sensitive receptors. Any lighting during night time construction will be of short duration. Lighting will not be directed or spill into any adjoining landholding or dwelling. Occupants of adjoining dwellings would be advised of any night time construction and the proposed lighting requirements.	Construction contractor	Construction	Additional safeguard AS4282 – Control of the obtrusive effects of outdoor lighting, AS 1158.4:2015 <i>Lighting for roads and public spaces - Part 4: Lighting of pedestrian crossings</i>
PRP 1	Property acquisition	All property acquisition will be carried out in accordance with the <i>Land Acquisition Information Guide</i> (Roads and Maritime, 2012) and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> .	Roads and Maritime	Detailed design	Standard core safeguard <i>Land Acquisition Information Guide</i> (Roads and Maritime, 2012) <i>Land Acquisition (Just Terms Compensation) Act 1991</i> .
PRP 2		Carry out regular and ongoing engagement with the property owners affected by property acquisition.	Roads and Maritime	Detailed design	Additional safeguard
PRP 3	Adjacent land use impacts	Consult with potentially affected landholders before and during construction in accordance with the Communication Plan described in Section 6.3.4 to minimise the potential for impacts on land use.	Roads and Maritime	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
PRP 4	Neighbouring residential properties	Maintain safe access to impacted properties along Manns Road, Narara Creek Road and Maliwa Road during construction. Any disruption to access and properties will be minimised and will only be carried out following consultation and agreement with individual property owners affected by the work	Construction contractor	Construction	Additional safeguard
SOIL 1	Contaminated land	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other work that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA.	Construction contractor	Construction	Core standard safeguard Section 4.2 of QA G36 <i>Environment Protection</i>
SOIL 2	Exposure of soil to erosion	A soil and water management plan (SWMP) will be prepared as part of the CEMP in accordance with the requirements of Roads and Maritime contract specification G38 prior to the start of construction. The SWMP will address the following: <ul style="list-style-type: none"> • Roads and Maritime <i>Code of Practice for Water Management, the Roads and Maritime Erosion and Sedimentation Procedure</i> • The NSW Soils and Construction – <i>Managing Urban Stormwater Volume 1 ‘the Blue Book’</i> (Landcom, 2004) and Volume 2 (DECC, 2008) • <i>Roads and Maritime Stockpile Site Management Guideline</i> (Roads and Maritime, 2015) • <i>Technical Guideline: Temporary Stormwater Drainage for Road Construction</i>, (Roads and Maritime 2011) • <i>Technical Guideline: Environmental Management of Construction Site Dewatering</i>, (Roads and Maritime 2011). 	Construction contractor	Construction	Additional safeguard QA G36 <i>Environment Protection</i>
SOIL 3		Prepare and implement a progressive erosion and sediment control plan prior to the start of each stage of construction. The plan would include a provision for disturbed areas of the site to be progressively scheduled for ground stabilisation and / or final landscaping treatment where possible at the end of each construction stage.	Construction contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SOIL 4		Develop an inspection and maintenance programme to check the adequacy of controls, particularly after a rainfall event.	Construction contractor	Construction	Additional safeguard
SOIL 5		Erosion and sediment controls would be retained and maintained until effective soil cover (at least 70 per cent coverage) is achieved.	Construction contractor	Construction	Additional safeguard
SOIL 6		Controls will be implemented at exit points to minimise the tracking of soil and particulates onto pavement surfaces. Any material transported onto pavement surfaces will be swept and removed at the end of each working day.	Construction contractor	Construction	Additional safeguard
SOIL 7	Accidental spill	A site specific emergency spill plan will be developed for inclusion in the CEMP, and include spill management measures in accordance with the Roads and Maritime <i>Code of Practice for Water Management</i> (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).	Construction contractor	Construction	Core standard safeguard Section 4.3 of QA G36 <i>Environment Protection</i> Roads and Maritime <i>Code of Practice for Water Management</i> (RTA, 1999)
SOIL 8		Fully equipped emergency spill kits would be kept on-site at all times	Construction contractor	Construction	Additional safeguard
SOIL 9	Storage and disposal of construction materials	Excess spoil not required or able to be used for backfilling would be stockpiled in a suitable location before being reused or removed from the site, and disposed of appropriately in accordance with the NSW EPA <i>Waste Classification Guidelines</i> (2014).	Construction contractor	Construction	Additional safeguard NSW EPA <i>Waste Classification Guidelines</i> (2014)

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SOIL 10		As part of the CEMP, measures for the management of mulch and tannin generated from clearing on the site will be prepared in accordance with the Roads and Maritime <i>Management of Tannins from Vegetation Mulch</i> (2012).	Construction contractor	Construction	Additional safeguard Roads and Maritime <i>Management of Tannins from Vegetation Mulch</i> (2012).
HYD 1	Surface water pollution	A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction.	Construction contractor	Construction	Core standard safeguard Section 2.1 of QA <i>G38 Soil and Water Management</i>
HYD 2	Soil and water	A site specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the SWMP. The Plan will include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.	Construction contractor	Construction	Core standard safeguard Section 2.2 of QA <i>G38 Soil and Water Management</i>
HYD 3	Water quality	Specific measures to be incorporated into the SWMP include: <ul style="list-style-type: none"> • Use existing grass lined drainage channels for clean water diversion where available • Install additional stabilised diversion drains where necessary to separate clean and dirty areas and incorporate necessary sediment and erosion controls • Treat highly chlorinated water prior to release in accordance with water company guidelines. 	Construction contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
HYD 4	Flooding and hydrology impacts	<p>The SWMP would include measures to maintain surface water flows during work on existing and new drainage and avoid localised flooding of the road and adjacent properties including:</p> <ul style="list-style-type: none"> • The provision of temporary alternative drainage arrangements during work on existing drainage lines • Removing debris, soil/gravel, equipment and other obstructions routinely following periods of work and before forecast wet weather • Not stockpiling materials below the mapped 10 year flood level in accordance with blue book requirements • Regular inspection during high rainfall events • Scheduling work wherever possible during low rainfall periods. 	Construction contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
TRA 1	Traffic and transport	<p>A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Roads and Maritime <i>Traffic Control at Work Sites Manual</i> (RTA, 2010) and QA <i>Specification G10 Control of Traffic</i> (Roads and Maritime Services, 2008). The TMP will include:</p> <ul style="list-style-type: none"> • Confirmation of haulage routes • Measures to maintain access to local roads and properties • Site specific traffic control measures (including signage) to manage and regulate traffic movement • Measures to maintain pedestrian and cyclist access • Requirements and methods to consult and inform the local community of impacts on the local road network and any local parking changes • Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads • A response plan for any construction traffic incident • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • Monitoring, review and amendment mechanisms. 	Construction contractor	Construction	<p>Core standard safeguard</p> <p>Section 4.8 of QA <i>G36 Environment Protection</i></p> <p><i>Traffic Control at Work Sites Manual</i> (RTA, 2010)</p> <p>QA <i>Specification G10 Control of Traffic</i> (Roads and Maritime Services, 2008)</p>
TRA 2	Traffic congestion	Construction activities which could substantially affect traffic congestion will be carried out outside peak periods, as far as is practicable.	Construction contractor	Construction	Additional safeguard
TRA 3		Heavy vehicle traffic will be restricted, as much as possible, to the existing main roads (such as Manns Road) to minimise impacts on local roads and streets.	Construction contractor	Construction	Additional safeguard
TRA 4	Access	Where access to property would be disrupted for an extended period, alternative access would be provided. Pedestrian access to properties will be maintained at all times.	Construction contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
ABH 1	Unexpected find of an Aboriginal heritage	The <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Roads and Maritime does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work will only re-start once the requirements of that Procedure have been satisfied.	Construction contractor	Construction	Core standard safeguard. Section 4.9 of QA G36 <i>Environment Protection</i> Unexpected Heritage Items (Roads and Maritime, 2015)
ABH 2		As part of the site induction, all workers will be advised of their obligations in relation to Aboriginal cultural heritage under the National Parks and Wildlife Act 1974 before construction begins and the guidelines to follow if unanticipated heritage items or deposits are located during construction.	Construction contractor	Construction	Additional safeguard
ABH 3		All site personnel will receive basic training in the recognition of Aboriginal cultural heritage sites and material and have an awareness of the importance of such material and places to both the Aboriginal and non-Aboriginal community.	Construction contractor	Construction	Additional safeguard
AIR1	General air quality impacts	An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to: <ul style="list-style-type: none"> • Potential sources of air pollution • Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines • Mitigation and suppression measures to be implemented • Methods to manage work during strong winds or other adverse weather conditions • A progressive rehabilitation strategy for exposed surfaces. 	Construction contractor	Construction	Core standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
AIR2	Dust emissions	Dust suppression measures will be implemented in accordance with the CEMP. This would include watering down the site, covering trucks when transporting dust generating material and covering, placing and managing stockpiles in accordance with <i>Stockpile Management Guideline</i> (RTA, 2011b).	Construction contractor	Construction	Additional safeguard
AIR3	Exhaust emissions	Construction plant and equipment will be maintained in a good working condition in order to limit impacts on air quality and plant and machinery will be turned off when not in use.	Construction contractor	Construction	Additional safeguard
AIR4	Impacts on sensitive receivers	Local residents will be advised of hours of operation and duration of work and supplied with a contact name and number for queries regarding air quality.	Construction contractor	Construction	Additional safeguard
OTH 1	Non-Aboriginal heritage	The <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered. Work will only restart once the requirements of that Procedure have been satisfied.	Construction contractor	Construction	Core standard safeguard Section 4.10 of QA G36 <i>Environment Protection</i>
OTH 2		An awareness package would be prepared as part of the site induction, informing all personnel of their responsibilities under the provisions of the National Parks and Wildlife Act, 1974 (including the penalties under the ancillary provisions) and NSW Heritage Act 1977. This induction should also include an outline of the Roads and Maritime Procedures for Unexpected Finds and the requirement to stop work immediately until this process is followed and these responsibilities are met.	Construction contractor	Construction	Additional safeguard
OTH 3	Groundwater	In the event dewatering of disturbed areas of the site is required, it would need to be carried out in accordance with the <i>Roads and Maritime Technical Guideline for dewatering</i> .	Construction contractor	Construction	Additional safeguard <i>Roads and Maritime Technical Guideline for dewatering</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
OTH 4	Waste	<p>A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to:</p> <ul style="list-style-type: none"> Measures to avoid and minimise waste associated with the proposal Classification of wastes and management options (re-use, recycle, stockpile, disposal) Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions Procedures for storage, transport and disposal Monitoring, record keeping and reporting. <p>The WMP will be prepared taking into account the <i>Environmental Procedure - Management of Wastes on Roads and Maritime Services Land</i> (Roads and Maritime, 2014) and relevant Roads and Maritime Waste Fact Sheets.</p>	Construction contractor	Construction	<p>Core standard safeguard</p> <p>Section 4.2 of QA G36 <i>Environment Protection</i></p> <p><i>Environmental Procedure - Management of Wastes on Roads and Maritime Services Land</i> (Roads and Maritime, 2014)</p>
OTH 5		<p>The following resource management hierarchy principles will be followed:</p> <ul style="list-style-type: none"> Avoid unnecessary resource consumption as a priority Avoidance will be followed by resource recovery (including reuse of materials, reprocessing, and recycling and energy recovery) Disposal will be a last resort (in accordance with the <i>Waste Avoidance and Resource Recovery Act 2001</i>). 	Construction contractor	Construction	<p>Additional safeguard</p> <p><i>Waste Avoidance and Resource Recovery Act 2001</i></p>
OTH 6	Utilities	<p>Prior to the start of work:</p> <ul style="list-style-type: none"> The location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners If the scope or location of proposed utility relocation work falls outside of the assessed proposal scope and footprint, further assessment will be conducted. 	Construction contractor	Construction	Core standard safeguard
OTH 7		Roads and Maritime would consult with relevant service providers during detailed design to identify possible interactions and develop procedures to be implemented to minimise the potential for service interruptions which have the potential to impact on existing land use.	Roads and Maritime	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
OTH 8	Hazards and risk management	<p>A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to:</p> <ul style="list-style-type: none"> • Details of hazards and risks associated with the activity • Measures to be implemented during construction to minimise these risks • Record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials • A monitoring program to assess performance in managing the identified risks • Contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations. <p>The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or Office of Environment and Heritage publications.</p>	Construction contractor	Construction	Core standard safeguard
OTH 9	Demand on resources	<p>Procurement and planning of construction will incorporate the following strategies:</p> <ul style="list-style-type: none"> • Procurement would endeavour to use materials and products with a recycled content where that material or product is cost and performance effective • Excavated material would be reused on-site for fill where feasible to reduce demand on resources. • Any additional fill material required would be sourced from appropriate local sources and/or other Roads and Maritime projects. 	Construction contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
OTH 10	Energy efficiency	<p>Vehicles, plant and equipment would be selected and managed according to the following:</p> <ul style="list-style-type: none"> • The selection process for vehicle and plant would consider energy efficiency and related carbon emissions • Equipment will be serviced frequently to ensure it is operating efficiently • Machinery will be operated efficiently to ensure optimal performance, minimise downtime and improve fuel efficiency. 	Construction contractor	Construction	Additional safeguard
CUM 1	Cumulative impacts	The construction environmental management plan would consider potential cumulative construction impacts from surrounding development activities, such as noise and dust, as they become known.	Contractor	Construction	Additional safeguard
CUM 2		Ongoing coordination and consultation would be carried out with other proponents to ensure potential cumulative impacts are appropriately assessed and managed.	Roads and Maritime	Detailed design	Additional safeguard

7.3 Licensing and approvals

Table 7-2 summarises notifications, licences and approvals required for the proposal.

Table 7-2: Summary of licensing and approvals required

Instrument	Requirement	Timing
<i>Protection of the Environment Operations Act 1997</i> (s43)	Environment protection licence (EPL) for scheduled activities under Clause 19 – extractive industries for the extraction, processing or storage of more than 30,000 tonnes per year of extractive materials.	Prior to start of the activity.
<i>Water Management Act 2000</i> (s91C)	Drainage work approval from DPI (Water). Roads and Maritime to discuss with DPI Water.	Prior to start of the activity.

8. Conclusion

8.1 Justification

The Narara Creek Road intersection is in a strategic location as it forms part of the link between the Central Coast Highway and the M1 Pacific Motorway, but is also between Showground Road and Manns Road. It is also the only intersection in the area with traffic lights, accessing subdivisions to the west and northwest and allowing a safe turn from and to Manns Road particularly during busy traffic periods.

The proposal is considered to be justified as it would reduce existing and forecast increasing traffic delays and congestion along Manns Road near the intersection. Without construction of the proposal, traffic congestion would worsen with modelling predicting a reduction in vehicle speeds to about 25 kilometres per hour for northbound traffic and seven kilometres per hour for southbound traffic towards the intersection.

Lowering of the existing crest on Manns Road through the intersection as part of the proposal would also contribute to improving safety by improving visibility on Manns Road for the northbound approach to the intersection. The proposal would also provide new connected pedestrian footpaths, shared pathway and cycle lanes connecting to the traffic light crossings, to promote community access and active transport opportunities.

While there would be environmental impacts as a consequence of the proposal, they have been avoided or minimised wherever possible through design and site-specific safeguards summarised in Section 7.

8.2 Objects of the EP&A Act

Table 8-1 identifies the objects of the EP&A Act and their relevance to the proposal.

Table 8-1: Objects of the EP&A Act

Object	Comment
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	<p>The proposal is needed to improve the travel times and safety for the Narara Creek Road intersection. The proposal would result in reduced traffic delays and would extend existing cyclist and pedestrian facilities within the proposal footprint.</p> <p>The proposal would result in some traffic and amenity impacts during construction and would require strip acquisition of two residential and two educational properties. A number of mitigation measures would be implemented to minimise any environmental impacts associated with the proposal.</p>
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	<p>Construction of the proposal would require the removal of a small amount of common and exotic species comprising exotic grassland and native planted and remnant trees and a small area of native woodland comprising 0.88 hectares of PCT 1579 Smooth-barked Apple – Turpentine – Blackbutt open forest on ranges of the Central Coast. Vegetation clearing would be reduced as much as possible during construction and an area of EEC would be demarcated to prevent impact. Relevant economic, environmental and social aspects were considered as part of the design. Discussed further in Sections 6.2 and 6.3.</p>
1.3(c) To promote the orderly and economic use and development of land.	<p>The proposal is needed as part of a broader upgrade designed to progressively improve Manns Road to reduce travel time and improve safety, which would provide for future growth and development in Narara.</p>
1.3(d) To promote the delivery and maintenance of affordable housing.	<p>Not relevant to the project.</p>

Object	Comment
<p>1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.</p>	<p>The proposal has been subject to a comprehensive biodiversity assessment as described in Section 6.2 of this REF and the study area included a wider strategic investigation area from Stockyard Place to Wananda Street which addressed the entirety of the proposal boundary.</p> <p>Within the proposal footprint, exotic grassland with scattered and planted trees, and native woodland comprising 0.88 hectares of PCT 1579 Smooth-barked Apple – Turpentine – Blackbutt open forest on ranges of the Central Coast would be removed. The woodland is not commensurate with a threatened ecological community, but it comprises potential habitat for three threatened microbat species - one of which was recorded during field survey and two have a moderate likelihood of occurring.</p> <p>Assessments of significance were conducted under Section 7.3 of the BC Act for three threatened microbat species and found there would be no significant impact to these species as a result of the proposal, and as such, impacts to areas of significant biodiversity value would not occur.</p> <p>The proposal would not significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the BC Act, EPBC Act or FM Act.</p>
<p>1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).</p>	<p>A Roads and Maritime PACHCI Stage 2 consultation, assessment and inspection confirmed no Aboriginal archaeological sites or areas of cultural significance are located within the proposal footprint and therefore no impact to cultural heritage is likely to occur. No heritage buildings occur within the proposal footprint.</p>
<p>1.3(g) To promote good design and amenity of the built environment.</p>	<p>The proposal has considered community amenity and urban design principles, with a specialist landscape and urban design report having been completed to inform the proposal design. The urban design concepts would provide an improved and consistent landscape character, resulting in a positive visual and amenity impact compared with existing conditions.</p>
<p>1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.</p>	<p>Not relevant to the project.</p>
<p>1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.</p>	<p>Not relevant to the project.</p>
<p>1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.</p>	<p>The proposal has involved extensive consultation with relevant stakeholders during the preparation of the proposal REF. Consultation carried out is discussed in Section 5 of this REF. Consultation would be ongoing during construction.</p>

8.2.1 The precautionary principle

This principle states '*if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation*'.

Consultation considered issues raised by stakeholders and a range of specialist studies were carried out for key issues to provide accurate and impartial information to assist in the development process.

The concept design has sought to minimise impacts while maintaining engineering feasibility and safety for all road users. A number of safeguards have been proposed to minimise potential impacts. These safeguards would be implemented during detailed design, construction and operation of the proposal. No safeguards have been postponed as a result of lack of scientific certainty.

A construction environmental management plan would be prepared before construction starts. This would ensure the proposal achieves its required level of environmental performance. No mitigation measures or management mechanisms would be postponed as a result of a lack of information.

8.2.2 Intergenerational equity

This principle states, '*the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations*'.

The proposal would result in some amenity impacts during construction, however, it would not result in any impacts which are likely to adversely impact on the health, diversity or productivity of the environment for future generations. The proposal would benefit future generations by ensuring road safety and travel time is improved, with this being a positive benefit for all road users.

Should the proposal not proceed, the principle of intergenerational equity may be compromised, as public safety may be affected by future traffic incidents and congestion associated with Manns Road. As an early phase of the final Stage 5 upgrade between Narara Creek Road and Stockyard Place (currently in planning), it also contributes to the larger strategic objectives for the Pacific Highway and Manns Road corridor, which is being progressively upgraded to improve road user safety and road capacity to reduce travel time and meet forecast future traffic volumes.

8.2.3 Conservation of biological diversity and ecological integrity

This principle states the '*diversity of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, must be maintained and improved to ensure their survival*'.

The environment in which the proposal would be located is predominantly exotic and/or planted vegetation. A small number of remnant and planted native trees would be impacted, comprising 0.88 hectares of PCT 1579 Smooth-barked Apple – Turpentine – Blackbutt open forest on ranges of the Central Coast. The vegetation which would be removed from the proposal footprint comprises habitat for threatened species including one microbat and potential habitat for two other microbats. Woodland provides habitat for a range of fauna as discussed in Section 6.2.2. An assessment of the existing environment was carried out to identify and manage any potential impacts of the proposal on local biodiversity.

The proposal would not have a significant impact on biological diversity and ecological integrity. A biodiversity assessment and appropriate site-specific safeguards are provided in Section 6.2.

8.2.4 Improved valuation, pricing and incentive mechanisms

This principle requires '*costs to the environment should be factored into the economic costs of a project*'.

The REF has examined the environmental impacts and benefits of the proposal and identified mitigation measures to manage the potential for adverse impacts. The requirement to implement these mitigation measures would result in an economic cost to Roads and Maritime. The implementation of mitigation measures would increase both the capital and operating costs of the proposal. This signifies environmental resources have been given appropriate valuation.

The concept design has been developed with an objective of minimising potential impacts on the surrounding environment. This indicates the proposal is being developed with an environmental objective in mind.

8.3 Conclusion

The proposed upgrade of Narara Creek Road intersection at Narara is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration (where relevant) of conservation agreements and plans of management under the NP&W Act, biodiversity stewardship sites under the BC Act, wilderness areas, areas of outstanding value, impacts on threatened species and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Federal EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the proposal objectives but would still result in some residual impacts, including:

- **Noise and vibration –**

Residents and educational facilities near the proposal would experience elevated noise levels during construction, some of which are predicted to be highly noise affected during standard working hours. Construction noise will be managed through the safeguards in this REF and a *Construction Noise and Vibration Management Plan*.

The operational noise assessment also identified sensitive receivers which potentially qualify for further consideration of road traffic noise treatment, comprising 19 residential receivers, two place of worship buildings and a number of educational buildings. Types and extent of treatments for these receivers would be further assessed and developed in detail during design.

- **Biodiversity –**

The proposal would involve the removal of a small area of low condition native vegetation corresponding to PCT 1579: Smooth-barked Apple – Turpentine – Blackbutt open forest on ranges of the Central Coast, which is not threatened under state or federal legislation and has no requirement for offsets under RMS Biodiversity Offsets Policy. No further impacts on threatened species or communities have been identified. Impacts can be managed satisfactorily through standard safeguards identified in this REF and a Flora Fauna Management Plan in construction.

- **Socio-economic –**

During construction there would be a temporary inconvenience to the local community and businesses as a result of traffic congestion, altered access and reduced amenity due to noise and dust impacts. Ongoing engagement with property owners and the community through a number of management plans identified in this REF, and implemented through a *Construction Environmental Management Plan*, will reduce impacts on the local community and schools.

- **Soil and water –**

The southern portion of the proposal footprint would be excavated below current road levels to decrease the grade and increase the line of sight on Manns Road just south of Narara Creek Road. The proposal would also require excavating into the steep slope south west of the proposal footprint to accommodate the additional traffic lanes at the intersection and approaches. To the north in the proposal footprint there will be disturbance to and additional of extra material to broad areas of sloping roadside.

A range of safeguards have been included in this REF and are considered satisfactory to manage impacts, including development of a detailed Soil and Water Management Plan and progressive erosion and sediment control plans in construction.

- **Traffic and access –**

The construction of the central median would restrict access to and from residential properties along part of Manns Road to left in, left out only. This may require residents to take short alternate routes.

One bus bay would be removed as a result of the proposal, located on the west of Manns Road just north of the intersection. This bus bay has a low frequency of use and an alternative 150 metres away in the proposal footprint, accessed via crossings at traffic lights.

During construction, short-term restricted access and congestion is likely within the proposal footprint. Areas affected by construction would be staged to minimise the impact to receivers as much as possible, with a requirement for maintaining temporary and alternative access for vehicles and pedestrians to commercial premises.

The proposal would also improve safety and reduce travel times, provide improved community connection through pedestrian and cycling provisions and provide an improved and consistent landscape character, resulting in a positive visual and amenity impact compared with existing conditions. On balance the proposal is considered justified.

Significance of impact under NSW legislation

The proposal would be unlikely to cause a significant impact on the environment. Therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Council is not required.

Significance of impact under Australian legislation

The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*. A referral to the Australian Department of the Environment and Energy is not required.

9. Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.



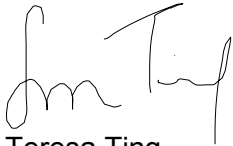
Katie Ward

Senior Environmental Scientist

GHD Pty Ltd

Date: 01 May 2019

I have examined this review of environmental factors and accept it on behalf of Roads and Maritime Services.



Teresa Ting

Project Manager

Roads and Maritime Services Central

Coast Date: 15 May 2019

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Terms and acronyms used in this REF

Term/Acronym	Description
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ARI	Average recurrence interval
ASS	Acid Sulphate Soils
BC Act	Biodiversity Conservation Act 2016
CEMP	Construction Environmental Management Plan
CLM Act	Contaminated Land Management Act 1997
CNML	Construction Noise Management Levels
Construction footprint	Areas which would be directly impacted by construction of the proposal (including compounds)
dB(A)	Unit used to measure 'A-weighted' sound pressure levels.
EPA	NSW Environmental Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW). Provides the legislative framework for land use planning and development assessment in NSW.
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
EPL	Environment protection licence
ESCP	Erosion and Sediment Control Plan
DPI	Department of Primary Industries
FM Act	Fisheries Management Act 1994 (NSW).
GHD	GHD Pty Ltd.
ISEPP	State Environmental Planning Policy (Infrastructure) 2007.
km/h	Kilometres per hour
LA90(period)	The sound pressure level exceeded for 90% of the measurement period.
LAeq (15 hr)	The LAeq noise level for the period 7.00 to 22.00 hours.
LAeq (1hr)	The highest hourly LAeq noise level during the day and night periods.
LAeq (9 hr)	The LAeq noise level for the period 22.00 to 7.00 hours.
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LGA	Local Government Area

Term/Acronym	Description
m3/s	cubic metres per second
MNES	Matters of national environmental significance
NPI	National Pollutant Inventory
NP&W Act	National Parks and Wildlife Act 1974 (NSW).
NSW	New South Wales
OEH	Office of Environment and Heritage
Phase 1	Upgrade of Narara Creek Road intersection and the southbound approach to Stockyard Place intersection
Phase 2	Remaining work within Stage 5, between Stockyard Place (northbound lanes) to about 300 metres south of Narara Creek Road/Maliwa Road intersection
PM10	Particulate matter
POEO Act	Protection of the Environment Operations Act 1997
The proposal	Upgrade the southbound approach to Stockyard Place intersection
Proposal footprint	areas which would be directly impacted by construction of the proposal including the operational design, additional area for possible stockpiles and compounds, temporary public and construction access, private property adjustments such as driveways and fences, and public utility relocations.
QA Specifications	Specifications developed by Roads and Maritime for use with roadwork and bridgework contracts let by Roads and Maritime
REF	Review of environmental factors.
Roads and Maritime	Roads and Maritime Services
RTA	NSW Roads and Traffic Authority which now forms part of Roads and Maritime.
Stage 5	The fifth stage of upgrade work for the Pacific Highway and Manns Road between the Central Coast Highway at West Gosford and the M1 Pacific Motorway at Ourimbah. Stage 5 includes all upgrade work between 300 metres north of Narara Creek Road, Narara, and the Stockyard Place intersection in Gosford



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