

Roads and Maritime Services M1 Pacific Motorway extension to Raymond Terrace

State Significant Infrastructure Application Report

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Executive summary

Introduction and need

Roads and Maritime Services (Roads and Maritime) is seeking approval for the extension of the M1 Pacific Motorway from Black Hill to the A1 Pacific Highway at Raymond Terrace.

The project involves building about 15 kilometres of four lane divided road with:

- Four interchanges located at Black Hill, New England Highway, Tomago and Raymond Terrace
- A viaduct about 2.6 kilometres long across the Hunter River and floodplain
- Structures to pass over local roads, the Main North Rail Line, New England Highway and the Chichester Trunk Gravity Water Main
- Overpass bridges at the existing A1 Pacific Highway at Heatherbrae and Masonite Road near Raymond Terrace.

The project would play a major role within the Lower Hunter road network, providing access to local centres such as Beresfield and Raymond Terrace, and also to major employment and commercial centres in the Hunter Region including Maitland, Port Stephens, Newcastle Airport, the City of Newcastle and the Port of Newcastle. The extension would provide one of the key outstanding motorway stages of the Pacific Motorway/Highway corridor between Sydney and Brisbane.

The project would provide traffic relief to the surrounding road network and improve traffic flows across the Lower Hunter region. The road network in the Lower Hunter currently suffers from traffic congestion and delays at key intersections. These issues are likely to worsen in the future as traffic volumes increase.

Planning and assessment process

The project is declared to be critical State significant infrastructure under section 115V of the *Environmental Planning and Assessment Act 1979* (EP&A Act), as it is considered to be essential to the State for economic, environmental or social reasons. The project was included in Schedule 5 Critical State significant infrastructure of the State Environmental Planning Policy (State and Regional Development) 2011, when it was gazetted on 28 September 2011.

In accordance with clause 16 of State Environmental Planning Policy (State and Regional Development) 2011, the project is also State significant infrastructure under section 115U of the EP&A Act and is permissible without consent under Part 4 of the EP&A Act. The project is, therefore, State significant infrastructure under Part 5.1 of the EP&A Act. The project requires the preparation of an environmental impact statement (EIS) and the approval of the Minister for Planning.

Proposed scope of the environmental impact statement

The outcomes of preliminary environmental investigations undertaken during development of the project have identified the key environmental issues that will require further detailed assessment and may require project-specific safeguards and management measures. These issues include:

- Hydrology and flooding
- Ground and surface water
- Biodiversity

- Aboriginal cultural heritage
- Traffic and transport
- Noise and vibration
- Landscape character and visual amenity.

This report supports an application under section 115X of the EP&A Act to carry out State significant infrastructure.

The purpose of this application report is to assist with the formulation of environmental assessment requirements by the Secretary of the Department of Planning and Environment under section 115Y of the EP&A Act.

A number of other environmental issues have also been identified. These issues are outlined within this report and are considered to be of lesser consequence taking into consideration the project scope, the existing environment and the implementation of standard management and safeguard measures.

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1 Introduction

1.1 Overview of the project

Roads and Maritime has been investigating the extension of the M1 Pacific Motorway from Black Hill to the A1 Pacific Highway at Raymond Terrace since 2004 (the project). The project involves building about 15 kilometres of four-lane divided road that would bypass Beresfield, Tarro, Hexham, Tomago and Heatherbrae.

The project is located within the Newcastle and Port Stephens local government areas (LGAs), about 20 kilometres north-west of the Newcastle Central Business District (CBD) and about 160 kilometres north of Sydney. The regional location of the project is shown in **Figure 1-1**.

The project would play a major role within the Lower Hunter road network, providing access to local centres such as Beresfield and Raymond Terrace, and also to major employment and commercial centres in the Hunter Region including Maitland, Port Stephens, Newcastle Airport, the City of Newcastle and the Port of Newcastle. The extension would provide one of the key outstanding motorway stages of the Pacific Motorway/Highway corridor between Sydney and Brisbane.

In 2014 Roads and Maritime initiated an extensive review of the 2010 concept design to identify and investigate potential improvements to the project. A revised concept design is now proposed and some of the benefits of the revised project include:

- Improved connectivity between the M1 Pacific Motorway and the Raymond Terrace Bypass, and for the rapidly growing Lower Hunter and Mid North Coast regions
- Improved road safety for local and through travellers
- Uninterrupted traffic flow along the motorway
- Better accessibility on and off the M1 Pacific Motorway for traffic
- Improvements to the adjoining road network
- Reduced impact on environmentally sensitive areas.

1.2 Purpose of this report

Roads and Maritime has prepared this application report to support a State significant infrastructure application under section 115X of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The project is declared in September 2011 to be critical State significant infrastructure under section 115V of the EP&A Act, by virtue of clause 16 and Schedule 5, clause 1(a) of State Environmental Planning Policy (State and Regional Development) 2011, as it is considered to be essential to the State for economic, environmental or social reasons.

In accordance with clause 16 of State Environmental Planning Policy (State and Regional Development) 2011, the project is also State significant infrastructure under section 115U of the EP&A Act and is permissible without consent under Part 4 of the EP&A Act. The project is, therefore, State significant infrastructure under Part 5.1 of the EP&A Act and requires the approval of the Minister for Planning.

The requirements of clause 192 of the Environmental Planning and Assessment Regulation 2000 for applications seeking approval of the Minister for Planning to

carry out State significant infrastructure are addressed in Attachment A of this application report.

The purpose of this application report is to assist with the formulation of environmental assessment requirements by the Secretary of the Department of Planning and Environment under section 115Y of the EP&A Act. The application report does the following:

- Describes the project
- Considers the potential environmental issues for the project
- Identifies the proposed scope of the environmental assessment and proposed further assessments.

This application report and the Secretary's environmental assessment requirements would inform the preparation of an environmental impact statement (EIS) for the project. The form and content of the EIS would be in accordance with clauses 6 and 7 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

1.3 Terms used in this report

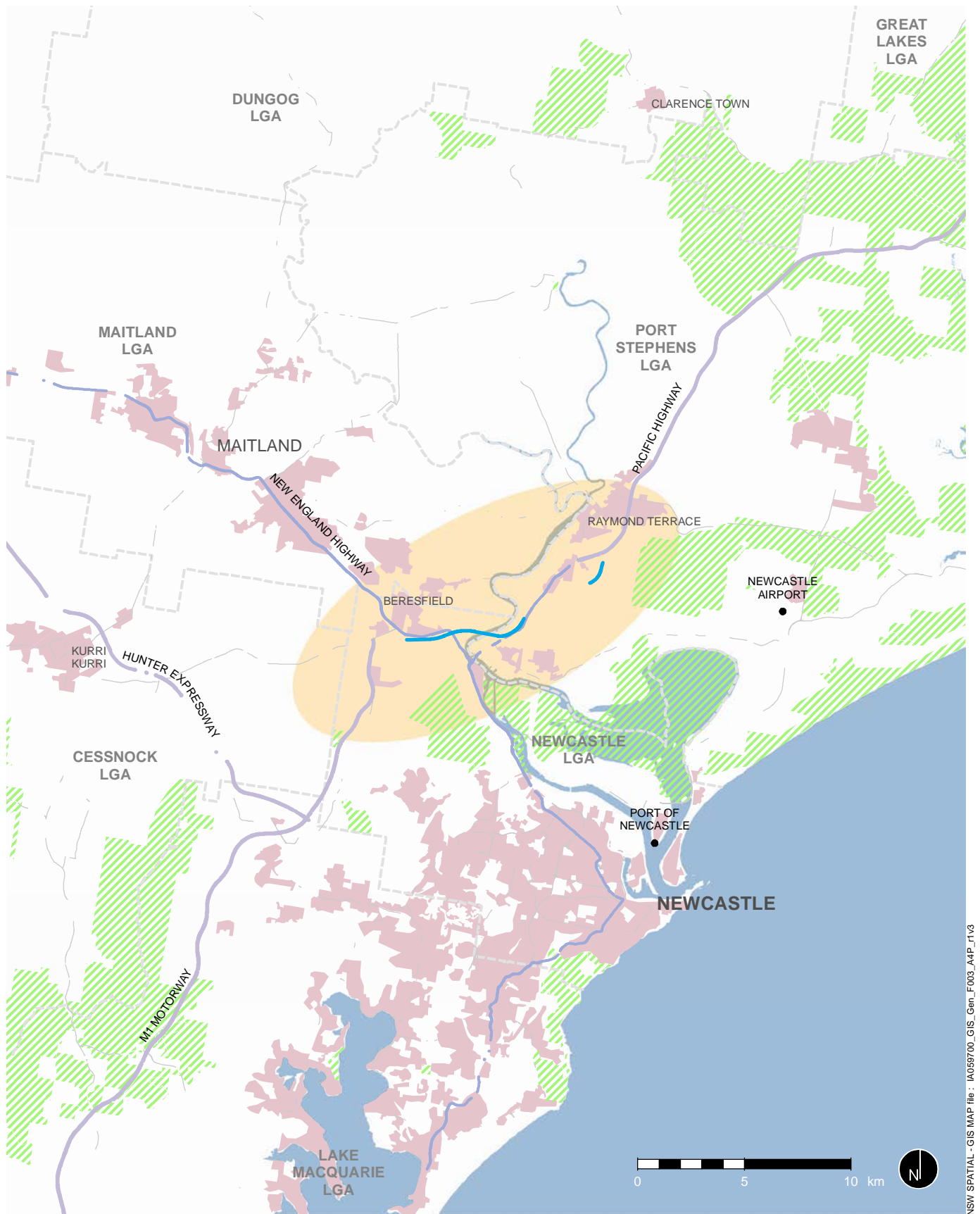
For the purposes of this application report:

- 'The project' refers to the extension of the M1 Pacific Motorway from the current end of the M1 Pacific Motorway to the A1 Pacific Highway at Raymond Terrace
- The 'project site' refers to the area that may be directly impacted by the project including areas required for construction and features ancillary to the project
- The 'study area' refers to the project area and the area that may be indirectly impacted by the project. The study area may differ for each environmental issue.

1.4 Structure of this report

This application report:

- Provides a summary of the strategic need and objectives of the project, the selection process, and community and stakeholder involvement (Chapter 2)
- Describes the main features of the project (Chapter 3)
- Provides an overview of the potential environmental impacts of the project (Chapter 4 and Chapter 5).



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— The project Built up area Reserves and state forests

Figure 1-1 Regional locality plan

2 Background

2.1 Strategic context and project need

The Australian and NSW governments have been jointly upgrading the Pacific Highway between Hexham and the Queensland border since 1996. The Pacific Highway upgrade aims to support regional development and provide:

- Safer travel
- Reduced travel times with improved freight transport efficiency
- More consistent and reliable travel
- Better access for towns and villages on the North Coast
- Improved amenity for local communities.

The New England Highway and A1 Pacific Highway between the M1 Pacific Motorway at Black Hill and Raymond Terrace form part of the National Land Transport Network. The project is one of the last major upgrades required to complete a high quality route between Sydney and Brisbane. The other projects are NorthConnex in northern Sydney and the Coffs Harbour Bypass. The project would form an essential part of the overall Pacific Highway upgrade, which is scheduled to complete a four-lane divided road between Hexham and the Queensland by 2020.

The project is also consistent with other NSW strategic plans:

- *NSW Government State Infrastructure Strategy* (NSW Government, 2012a): The strategy includes a commitment to proceed with detailed assessment and planning for the project in the short term, and, if feasible, to construct it within the medium-term
- *NSW Long Term Transport Master Plan* (NSW Government, 2012b): The plan notes the importance of the project for freight and identifies it as a medium to long term initiative
- *Hunter Strategic Infrastructure Plan* (NSW Government, 2014a): The plan aims to provide for the strategic infrastructure framework to inform future urban growth within the Hunter Metropolitan Area. The plan identifies the project as a priority to be delivered within the next six to 20 years.

Major intersections within the study area do not currently provide the most effective method of access to key regional destinations such as Newcastle, Newcastle Airport and Port of Newcastle, and the Hunter Valley. The project is required to improve safety, reliability and efficiency of travel within the Lower Hunter regional road network by better connecting the New England Highway, Hunter Expressway via John Renshaw Drive, Weakleys Drive, A1 Pacific Highway and Tomago Road. Improved safety, reliability and efficiency within the road network would benefit mining, industrial, commercial, employment, recreational and residential areas within these key destinations.

The current route between the M1 Pacific Motorway at John Renshaw Drive and the Raymond Terrace Bypass does not meet motorway standards. This route is not free flowing due to:

- The roundabout at the John Renshaw Drive and Weakleys Drive intersection. This intersection is currently proposed for upgrade to traffic signals under a separate project
- The roundabout at the A1 Pacific Highway and Masonite Road intersection

- Geometric constraints, including undesirable merging arrangements from John Renshaw Drive onto the New England Highway at Beresfield and tight curves northbound on Hexham Bridge
- Traffic lights along the route at Hank Street, Old Punt Road, Tomago Road and New England Highway at Hexham (southbound)
- Varied speed limits along the route
- Adjoining land use development with direct access.

Substantial road user delays are experienced within the network, particularly during peak periods. Intersections currently produce conflict points. The project would provide a free flowing, motorway standard road. Interchanges would reduce the number of conflict points currently at intersections, providing for a safer route. The project would reduce travel times along the route for all road users (including heavy vehicles).

Aspects of the existing road network currently do not adequately cater for heavy vehicles, providing inadequate access to the key employment areas including Tomago and the Port of Newcastle (via Tomago Road). For instance, higher productivity vehicles up to 30 metres in length heading south from the Tomago industrial area cross via the northbound bridge over the Hunter River during night time periods. During these times, other northbound traffic crosses the Hunter River on the northbound bridge in a contra-flow arrangement. The project would address this issue and allow higher productivity vehicles continuous access across the Hunter River without disrupting regular traffic flows. The project would also improve access to other key employment areas at Black Hill and Beresfield by improving interchanges at these locations.

Road access across the Hunter River floodplain, especially between Hexham and Raymond Terrace, is impacted during flooding events. The 2010 concept design only achieves one in 20 year flood immunity for one carriageway on the motorway between Hexham and Tomago. The project is targeting to provide a minimum of one in 20 year immunity along the length of the alignment (ie between Black Hill and Raymond Terrace), for both carriageways, improving access and safety during flooding events.

2.2 Project objectives

The primary objectives for the project are to:

- Develop a dual carriageway road targeting:
 - A crash rate of a maximum 15 crashes per 100 million vehicle kilometres travelled
 - A casualty crash rate of less than 0.3 casualty crashes per kilometre, per year, over the project length.
- Provide a free flowing route and reduce travel time between the M1 Pacific Motorway at Beresfield and Raymond Terrace
- Provide improved access to key employment areas such as Tomago, Beresfield, Black Hill and the Port of Newcastle for heavy vehicles, including higher productivity vehicles
- Provide a route which reduces the overall freight transport time and cost for heavy vehicles along the major north/south and east/west connections
- Provide a route that meets the geometric requirements for higher productivity vehicles (up to 30 metres in length)

- Provide a continuous four lane (minimum) motorway standard connection
- Provide a route that maximises connectivity benefit and supports the development of the Lower Hunter road network.

The secondary objectives for the project are to:

- Provide a minimum flood immunity of five per cent annual exceedance probability (AEP) to the edgelines and flood immunity and consistency with other Pacific Highway projects
- Minimise road user delay from incidents and road closures on the highway, particularly from vehicle crashes
- Develop a project promoting good practice urban design principles and minimise the effects on sensitive habitats, such as waterways and wetlands, native vegetation and fauna.

2.3 Selection of the preferred project

2.3.1 Options background

Figure 2-1 outlines the project development process to date.

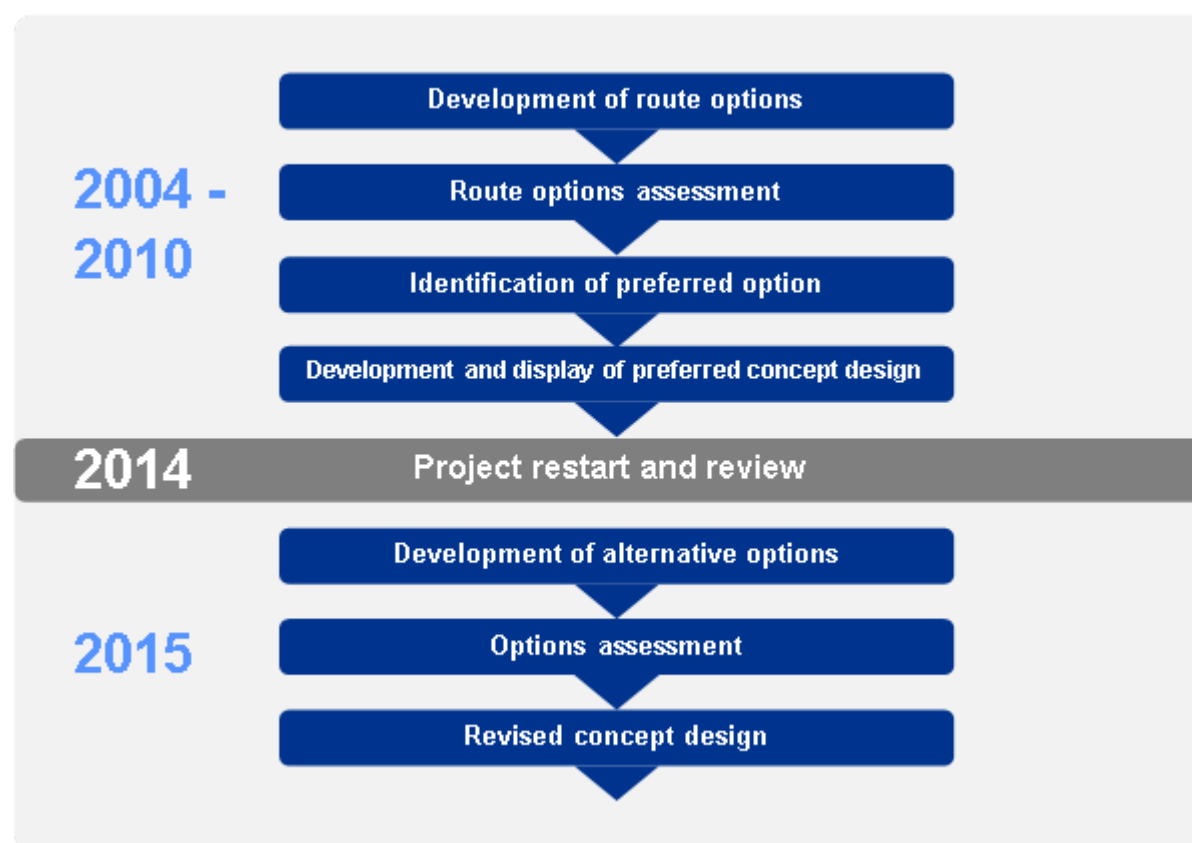


Figure 2-1 Project development process to date for the project

Route option development

Roads and Maritime commenced the options development of the project in 2004. Between December 2004 and January 2005, route options workshops identified 14 possible route options, with three selected for further analysis (Options A, B and C). These routes are shown in **Figure 2-2**.

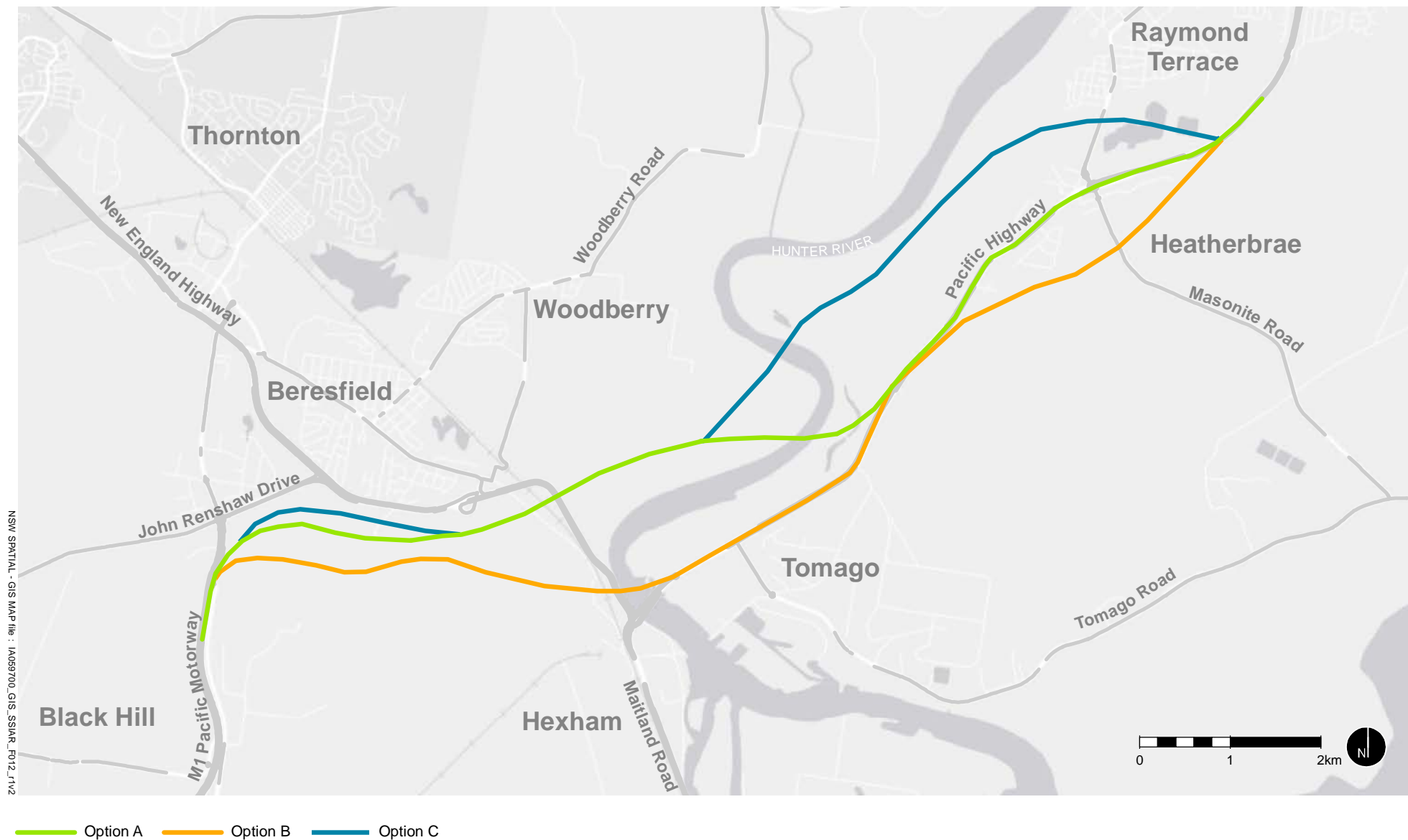


Figure 2-2 Route options considered for the project

The depth of the soft soil conditions within the Hunter River floodplain and the associated costs of construction were found to be unfeasible for route Option C. Accordingly, Roads and Maritime eliminated route Option C and proceeded to progress Option A and B as feasible route options. These options were split into three sections (western (1), central (2) and eastern (3)) and were named A1, A2, A3 and B1, B2, B3. These options were placed on public display between October 2005 and December 2005.

Options assessment

The options were evaluated within a value management process between November 2005 and February 2006. Key steps during this process were:

- Development of assessment criteria
- Value management workshop
- Further development of options as recommended at the value management workshop
- Further technical and environmental investigations
- Route selection workshop.

Evaluation criteria were developed before the value management workshop. These criteria were categorised into engineering, environmental, social and economic categories and were based on the Pacific Highway upgrade and project specific objectives, issues raised in the community involvement process, statutory requirements and policy guidelines for environmental issues.

The value management workshop held in December 2005 assessed each option against these evaluation criteria. The workshop recommended that further investigations be carried out on Option A1, B2 and A3.

Additional technical and environmental investigations were carried out and included ecology surveys, socio-economic assessment, land use and planning considerations (including cultural heritage), traffic modelling and revised cost estimates. Following this, Options A1, B2 and A3 were refined and considered at a route selection workshop in February 2006. These options were assessed by participants against criteria informed by previous stages of the project.

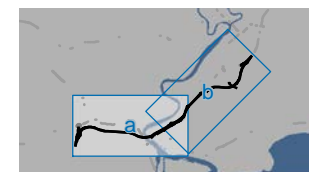
The workshop identified a composite of Option A1, Option B2 and Option B3 to be the preferred route for the project. The corridor for the preferred route was placed on public display between August and October 2006.

Public display

Following selection of this preferred route and consideration of the community and stakeholder feedback, Roads and Maritime progressed the concept design for the project. This concept design was placed on public display, with feedback sought from the community between July and August 2008. The 2010 concept design corridor (including refinements resulting from the submissions) was reserved in the Newcastle and Port Stephens Local Environment Plans (LEPs) after the submissions report responding to the issues raised from that display was issued in December 2010. The final 2010 concept design is shown on **Figure 2-3**.



- 2010 concept design
- Main Northern Railway
- LGA boundary

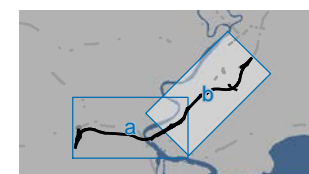


Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Jacobs 2015
 AUSIMAGE May 2014 and May 2015

Figure 2-3a 2010 concept design



- 2010 concept design
- Main Northern Railway
- LGA boundary



Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Jacobs 2015
 AUSIMAGE May 2014 and May 2015

Figure 2-3b 2010 concept design

2.3.2 *Project restart and review*

The NSW Government allocated funding for Roads and Maritime to recommence planning of the project in 2014, and a review of the concept design was carried out to identify and investigate potential improvements to the project.

The review found that further refinements of the alignment and concept design would improve connectivity with the local, regional and State road networks. The review also enabled lessons learnt from recent projects in floodplain and soft soil areas, such as the Pacific Highway bypass of Kempsey and Ballina to be incorporated. The key aspects of the project that were reconsidered included:

- The project's functionality and performance, including connectivity to the regional road network
- Design and geometric elements of the project, and how lessons learnt from recently completed Pacific Highway projects in floodplain and soft soil areas could be incorporated into a revised concept design
- Traffic characteristics, particularly regarding changes to the regional road network since the opening of the Hunter Expressway and completion of other road projects
- Environmental impacts, particularly regarding changes to environmental policy and legislation
- Integration with the existing transport network and the ability to accommodate any potential future upgrades.

2.3.3 *Development of options*

Development of options

Alternate alignments to the 2010 concept design were developed to address the issues identified in the project review. These options, Alignment 1 and Alignment 2, were progressed for further investigation. A number of interchange arrangements were also investigated at Black Hill, New England Highway/Tarro, Tomago, Heatherbrae and Raymond Terrace to address a key project objective of improving connectivity.

All options were located along a similar alignment to the 2010 concept design, with design changes located between Tarro and Tomago. The options that were considered are described in further detail below and shown on **Figure 2-3**.

2010 concept design (now referred to as Alignment 0)

This option generally refers to the concept design as displayed in December 2010. Changes were made to the Black Hill interchange and the A1 Pacific Highway east of Masonite Road to reduce weaving traffic movements, and a viaduct to replace the proposed embankment across the Hunter River floodplain was included to reduce impact to floodplain storage and constructability issues as a result of soft soils.

Alignment 1

This option runs between Alignment 0 and the New England Highway in a roughly parallel direction until the interchange at the New England Highway at Tarro. It crosses the Hunter River north of the existing bridges, passes through wetland areas and rejoins the existing A1 Pacific Highway at the Tomago Road intersection. This option was considered to provide a more constructible major bridge structure across the floodplain.

The project considered two variations of Tomago interchange on Alignment 1:

- Tomago 1A: with a northbound exit ramp directly into Tomago Road, northbound and southbound entry ramps at Pacific Highway north of Tomago Road via overpasses, a southbound entry ramp from Tomago Road and a northbound entry from Pacific Highway south of the Tomago Road intersection
- Tomago 1B: the alignment across the Hunter River was adjusted to avoid salt marsh and coastal wetlands. This arrangement provides northbound exit and southbound entry ramps at the Pacific Highway and Tomago Road intersection via an underpass, and northbound entry and southbound exit ramps at an upgraded Pacific Highway and Old Punt Road intersection. This alignment is a variation of Tomago 1A in response to recommendations made at the Value Management workshop (as discussed below).

Alignment 2

This option follows Alignment 1 until the New England Highway interchange at Tarro. It passes to the north of Alignment 1, and crosses the Hunter River to the north-east of the existing bridges, rejoining the A1 Pacific Highway at Tomago Road intersection. This alignment was primarily considered due to its major avoidance of the SEPP 14 wetland on the northern side of the Hunter River.

The project considered three variations of Tomago interchange on Alignment 2:

- Tomago 2A: provides a northbound exit ramp to the Tomago Road intersection via a reverse-loop ramp and northbound and southbound entry ramps from the Tomago Road intersection. A southbound exit ramp is provided at an upgraded Old Punt Road intersection
- Tomago 2B: provides a northbound entry ramp from Tomago Road intersection, a northbound exit ramp flying over the alignment to join Pacific Highway southbound and southbound entry and exit ramps at Tomago Road intersection
- Tomago 2C: provides a northbound entry ramp from Pacific Highway west of Tomago Road via a flyover. A northbound entry and exit ramp and a southbound entry ramp are also provided east of Tomago Road via a roundabout and overpass over the alignment. This overpass would connect to new intersections at Old Punt Road and Tomago Road. A southbound exit ramp connects to an upgraded Pacific Highway and Old Punt Road intersection. This variation of Alignment 2 was developed following recommendations from the Value Management Workshop and further investigations and is an evolution of Tomago 2A.

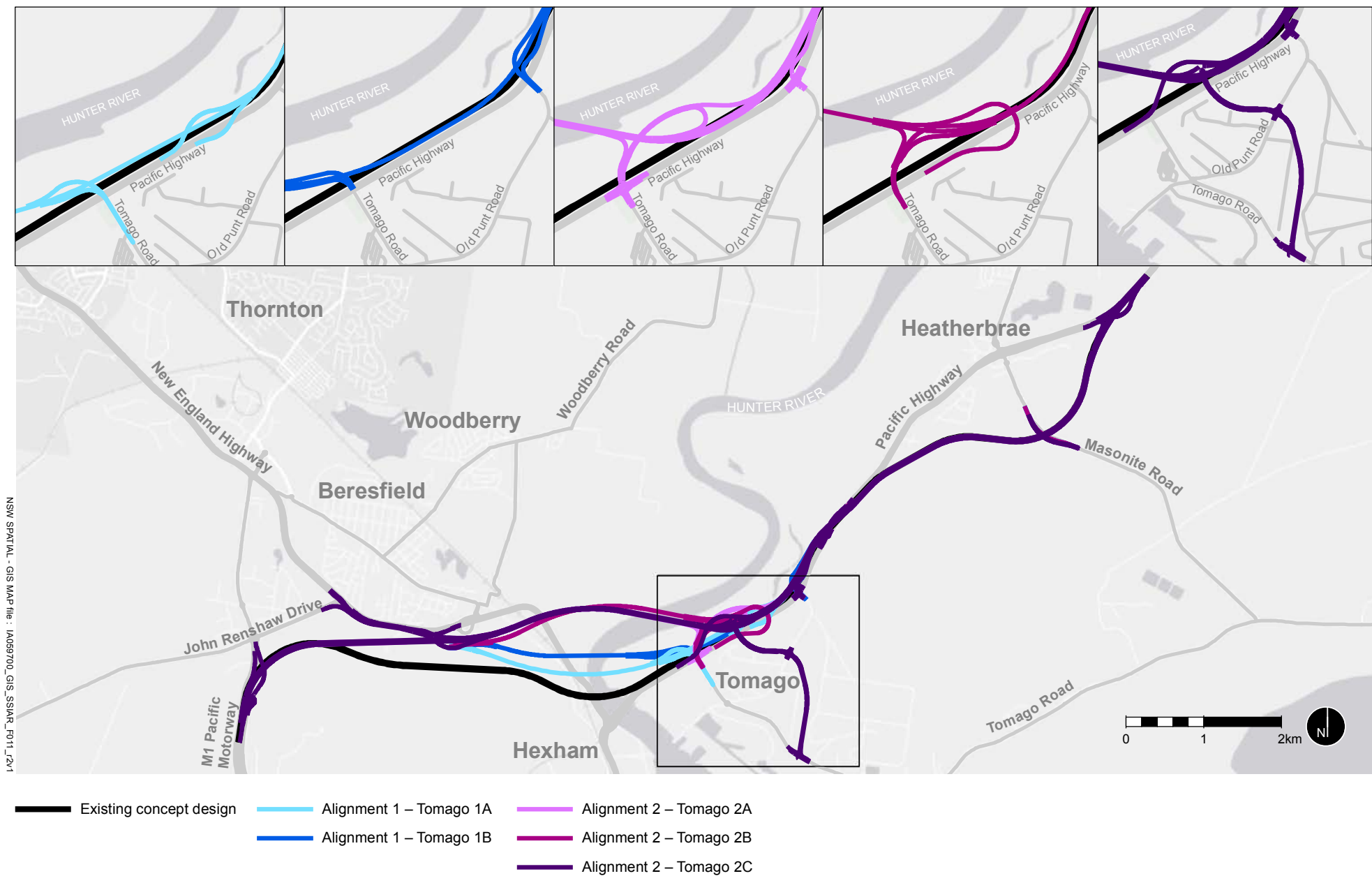


Figure 2-4 Options

Options assessment

The assessment process was carried out within a value management process. Values important to the project were identified through desktop investigations and during collaborative workshops and meetings with key stakeholders. These values informed the assessment criteria which were used to identify a preferred option.

A value management workshop was held on 28-29 April 2015 with the Roads and Maritime project team, project stakeholders, local council representatives and representatives of the community. The options assessed during the value management workshop were Alignment 0, Alignment 1 – Tomago 1A, Alignment 2 – Tomago 2A and Tomago 2B.

The workshop used criteria in the following categories against which to assess the options:

- Functional
- Social and economic
- Natural environment and culture.

These criteria were based on those used for previous options assessments for the project, and also drew upon the Pacific Highway upgrade objectives and the project objectives. **Table 2-1** summarises the performance of each option.

Table 2-1 Performance of each option

Option	Advantages	Disadvantages
Alignment 0	Existing corridor that requires the least number of new property acquisitions.	Impacts on high value biodiversity areas including SEPP 14 wetlands north and south of the Hunter River. Has poor functionality and connectivity to the local road network, particularly at Black Hill and Tomago. Alignment requires the bridge crossing of the Hunter River to be widened and constructed as twin bridges.
Alignment 1 – Tomago 1A	Improved functional performance at Black Hill and Tarro with new interchanges proposed providing improved connectivity to the adjoining road network. Improved alignment providing simpler construction than Alignment 0. Grade separated interchange at Tomago provides improved functionality over Alignment 0.	Worst performer on the basis of environmental impact. In particular, this option would have a major impact on the wetlands located on the northern side of the Hunter River. Tomago interchange could have constructability issues due to proximity to flood plain and environmental constraints Does not have the improved connectivity of other options at Tomago.

Option	Advantages	Disadvantages
Alignment 1 – Tomago 1B	<p>Improved functional performance at Black Hill and Tarro with new interchanges proposed providing improved connectivity to the adjoining road network.</p> <p>Improved alignment providing simpler construction than Alignment 0.</p> <p>Improved alignment over Alignment 1A due to decreased impact on environmentally sensitive areas including of the SEPP 14 wetland south of the river and the Federally listed coastal salt marsh north of the river.</p> <p>Tomago interchange provides improved connectivity by connecting to existing traffic signals at Tomago Road and Old Punt Road.</p>	<p>This option would still have a major impact on the wetlands located on the northern side of the Hunter River.</p> <p>Tomago interchange performs with less functionality and road safety due to connection into the signalised intersection.</p> <p>Tomago interchange could have constructability issues due to proximity to flood plain and environmental constraints.</p>
Alignment 2 – Tomago 2A	<p>Improved functional performance at Black Hill and Tarro with new interchanges proposed providing improved connectivity to the adjoining road network.</p> <p>Minimises environmental impact (i.e. avoids severance of high quality vegetation and avoids the majority of the SEPP 14 wetlands north and south of the river).</p> <p>Improved alignment providing simpler construction than Alignment 0.</p> <p>Tomago interchange provides improved connectivity by connecting to existing traffic signals at Tomago Road and Old Punt Road.</p>	<p>Requires new acquisitions of property in comparison to the Alignment 0 option.</p> <p>Requires a more complex Hunter River bridge crossing due to angle of river crossing.</p> <p>Road safety issues at proposed northbound exit ramp to Tomago (reverse loop).</p> <p>Tomago interchange could have constructability issues due to proximity to flood plain and environmental constraints.</p>

Option	Advantages	Disadvantages
Alignment 2 – Tomago 2B	<p>Improved functional performance at Black Hill and Tarro with new interchanges proposed providing improved connectivity to the adjoining road network.</p> <p>Minimises environmental impact (ie avoids severance of high quality vegetation and avoids the majority of the SEPP 14 wetlands north and south of the river).</p> <p>Improved alignment providing simpler construction than Alignment 0.</p>	<p>Requires new acquisitions of property in comparison to the Alignment 0 option.</p> <p>Requires a more complex Hunter River bridge crossing due to angle of river crossing.</p> <p>Tomago interchange provides less functionality for changed northbound exit. Additional infrastructure requirements to provide the interchange.</p> <p>Tomago interchange could have constructability issues due to proximity to flood plain and environmental constraints.</p>
Alignment 2 – Tomago 2C	<p>Improved functional performance at Black Hill and Tarro with new interchanges proposed providing improved connectivity to the adjoining road network.</p> <p>Minimises environmental impact (ie avoids severance of high quality vegetation and avoids the majority of the SEPP 14 wetlands north and south of the river).</p> <p>Improved alignment providing simpler construction than Alignment 0.</p> <p>Tomago interchange provides improved connectivity and functionality due to provision of grade separated interchange.</p> <p>Allows for improved constructability of Tomago interchange, predominantly out of the flood plain and located for simplified construction.</p>	<p>Requires new acquisitions of property in comparison to other options, due to additional new link road at Tomago.</p>

The value management workshop recommended additional design and assessment work be carried out for Tomago 1A and Tomago 2A by:

- Reducing the environmental impact of Tomago 1A
- Reviewing the functionality of the Tomago interchange for Tomago 2A.

The value management workshop concluded that Alignment 0 and Tomago 2B would not proceed.

Further design and assessment work was carried out on Tomago 1A and Tomago 2A as recommended by the value management workshop.

Tomago 1A was refined to include an at-grade intersection at Tomago Road that was comparable to the intersection at Tomago 2A. Its alignment was also adjusted to reduce impacts on ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* and the *Threatened Species Conservation Act 1995*. This resulted in Tomago 1B.

Tomago 1B and Tomago 2A were found to have similar functionality and costs. However, Tomago 2A was preferred as it avoided sensitive wetland areas near the Hunter River. Tomago 2A was further refined to improve the Tomago interchange and achieve a longer-term solution to meet traffic demand, resulting in Tomago 2C. Further investigation and assessment including traffic analysis, capital costs, and environmental factors showed that Tomago 2C performs the best as a further improvement to Tomago 2A.

A comparison of Tomago 1B, Tomago 2A and Tomago 2C found that the construction cost estimates are similar for the options. Accordingly, Tomago 2C was selected as the preferred option as it would avoid the high value biodiversity areas located either side of the Hunter River compared to Alignment 0 and 1, and would best balance the functional, social and economic and natural environment and culture considerations.

The preferred project

The preferred option for the revised concept design is Alignment 2 – Tomago 2C which is the preferred project. This option has less environmental impacts, provides better opportunities to connect to the regional road network, improves interface and constructability across existing rail and road infrastructure and best allows for future urban development.

The preferred project would meet the project objectives by:

- Providing a motorway standard dual carriageway road with a minimum of four lanes for the length of the project
- Increasing the speed limit to 110 kilometres per hour, halving travel time between Black Hill and the Raymond Terrace Bypass
- Improving access to key employment areas such as Tomago, Beresfield, Black Hill and the Port of Newcastle with interchanges that integrate with the local road network, while retaining existing access
- Improving access for higher productivity and oversized vehicles within the study area and to Tomago industrial area
- Improving flood access for the Lower Hunter across the Hunter River floodplain, by providing a one in 100 year flood immunity between the M1 Pacific Motorway and Tomago Road and a one in 20 year flood immunity for the project overall
- Providing a design that would manage ongoing and incident road runoff through the Hunter Water drinking water catchment (specifically the Tomago Sandbeds which supply water for Newcastle).

2.4 Issues raised during consultation

A consultation and community involvement program has been carried out since planning for the project started. The program has included public displays and community comment periods to support the preferred route, concept design and refined concept design.

Key stages where consultation informed the development of the project are as follows:

- Initial route options were displayed for community comment in 2005
- An options workshop was held with a community liaison group in February 2005 to discuss preferred options
- A preferred route was displayed for community comment in October 2006
- A concept design was displayed for community comment in 2008. There were 150 submissions received and considered in a refined concept design. The main issues raised included:
 - Access and interchange arrangements
 - Flooding and water quality impacts
 - Noise impacts
 - Signage and businesses
 - Flora and fauna impacts.

Since Roads and Maritime initiated the review of the 2010 concept design in 2014, there have been a series of meetings with key stakeholders. The purpose of these meetings has been to seek views on the project and confirm whether there have been any changes to land uses since public announcements in 2010 and how these changes may affect the project.

2.5 Ongoing consultation

Consultation and community involvement would be ongoing throughout the concept design development and environmental assessment phases of the project. Future consultation for the project would include:

- Consultation with government stakeholders, including local councils
- Public display of the refined concept design in October 2015, which will give further opportunity to review the concept design and provide feedback to inform the EIS for the project
- An Aboriginal Focus Group and relevant consultation to inform the cultural heritage assessment for the project
- Written communication to all property owners within the vicinity of the proposed alignment which will advise of the environmental assessment process and the public display phase
- Public exhibition of the EIS which would be expected to occur in early 2017. This would be for a minimum of 30 days. Advertisements would be placed in newspapers advising of the public exhibition and where the EIS can be viewed. These would also provide advice about making a submission on the project, and would outline how these submissions would be considered and responded to during the planning process
- Community information sessions would be held during the public display periods.

The Roads and Maritime project website would be updated with new information throughout the planning process and will promote community comment periods and opportunities for stakeholder input.

3 Project description

3.1 The project

Roads and Maritime is proposing the extension of the M1 Pacific Motorway from Black Hill to the A1 Pacific Highway at Raymond Terrace (the project). The project would comprise building about 15 kilometres of four-lane divided road from the end of the M1 Pacific Motorway at Black Hill (1.5 kilometres south of the John Renshaw Drive roundabout) connecting to the existing A1 Pacific Highway at Raymond Terrace (2.5 kilometres north of Masonite Road, Heatherbrae).

The project would play a major role within the Lower Hunter road network, providing access to local centres such as Beresfield and Raymond Terrace, and also to major employment and commercial centres in the Hunter Region including Maitland, Port Stephens, Newcastle Airport, the City of Newcastle and the Port of Newcastle. The extension would provide one of the key outstanding motorway stages of the Pacific Motorway/Highway corridor between Sydney and Brisbane.

The project would include the following key features (refer to **Figure 3-1**):

- Four lane divided road (two lanes in each direction) with median separation to accommodate a future upgrade to six lanes if required
- Four interchanges located at Black Hill, New England Highway, Tomago and Raymond Terrace
- A viaduct about 2.6 kilometres long across the Hunter River and floodplain
- Bridge structures to pass over local roads, the Main North Rail Line, New England Highway and the Chichester Trunk Gravity Water Main
- Overpass bridges at the existing A1 Pacific Highway at Heatherbrae and Masonite Road near Raymond Terrace
- Construction of earthen embankments as part of the highway formation
- A major cutting at Black Hill.

The concept design for the project would be refined as part of the environmental assessment where required.

3.2 Key project elements

3.2.1 Alignment

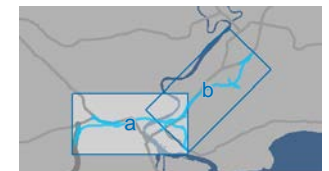
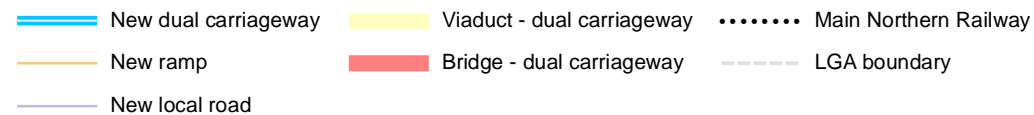
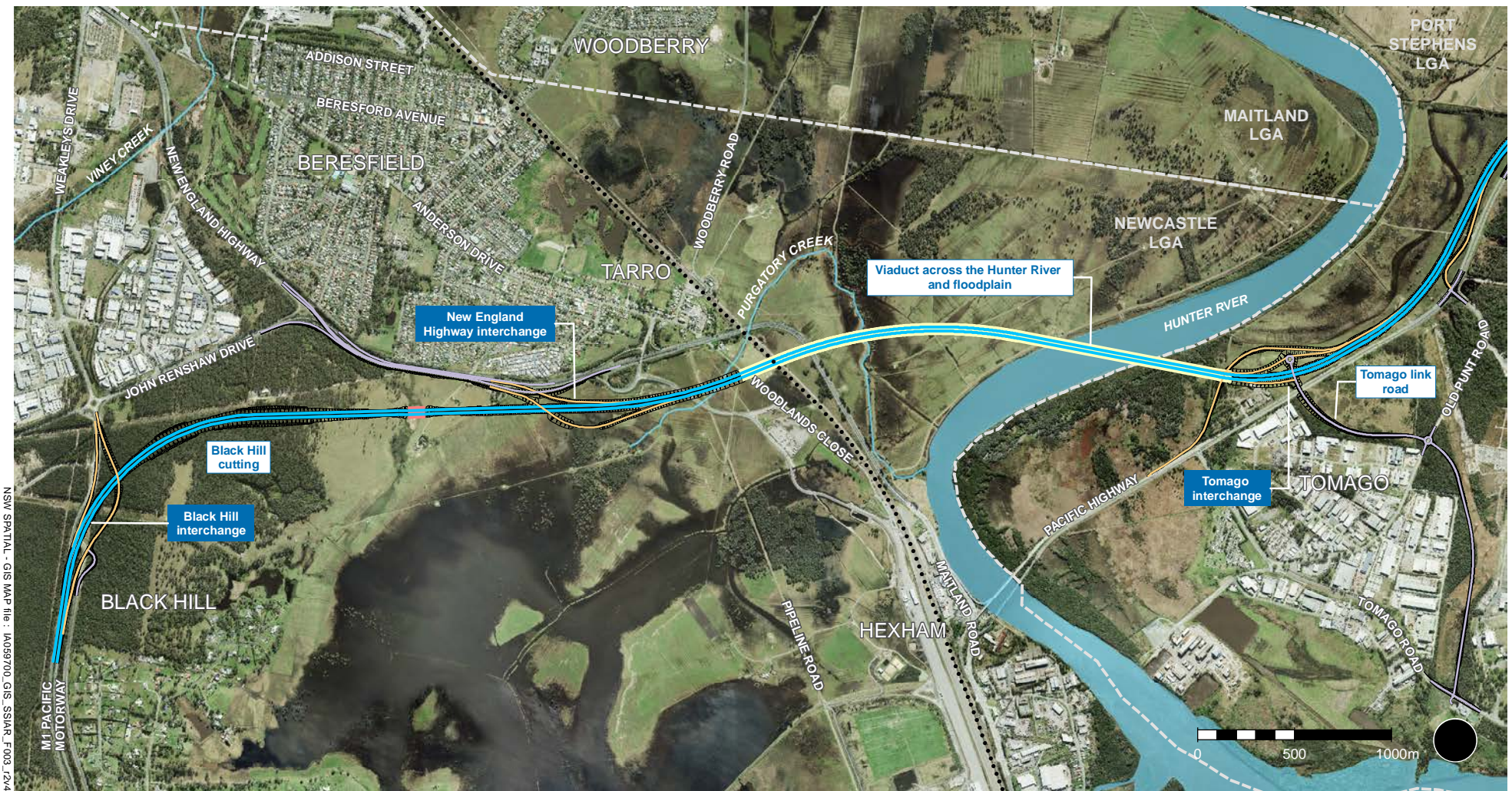
The southern limit of the proposed alignment is located about 650 metres south of Lenaghans Drive, at Black Hill. The proposed alignment then heads north before veering to the east directly after Lenaghans Drive, bypassing the John Renshaw Drive and Weakleys Drive roundabout, and continuing for about 2.2 kilometres. This allows for an interchange at the New England Highway at Tarro.

The proposed alignment then heads in a north-easterly direction, just before Woodlands Close, towards the Main North Rail Line. After crossing the railway line and the New England Highway, the proposed alignment continues in an easterly direction to the Hunter River. It crosses the Hunter River about 2.2 kilometres north of the existing Hexham Bridge, in a south-easterly direction.

After the Hunter River crossing, the proposed alignment continues towards the A1 Pacific Highway before running on the northern side and parallel to the A1 Pacific Highway. It then continues on the northern side of A1 Pacific Highway for about 900

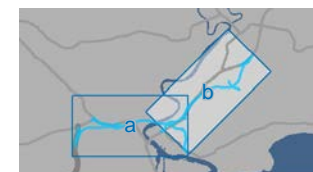
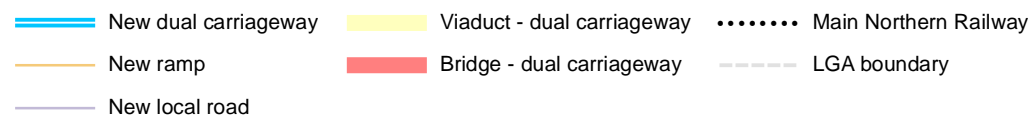
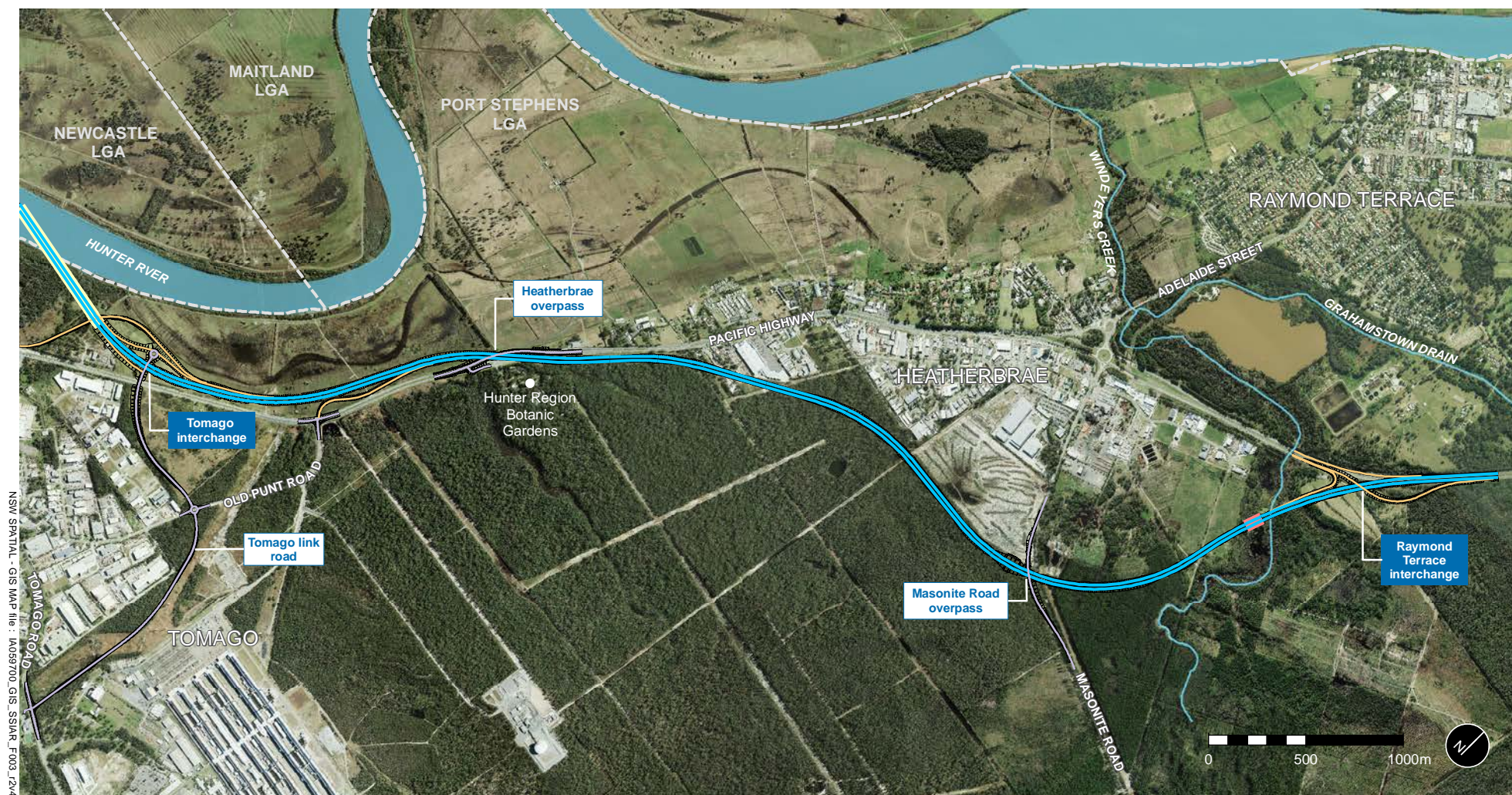
metres before crossing to the southern side. The proposed alignment then continues parallel to the southern side of the A1 Pacific Highway before veering north-east of Heatherbrae towards Masonite Road. It then heads in a more northerly direction for about 1.9 kilometres before re-joining the A1 Pacific Highway north of Windeyers Creek to form the Raymond Terrace interchange.

The proposed alignment is shown in **Figure 3-1**.



Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Jacobs 2015
 AUSIMAGE May 2014 and May 2015

Figure 3-1a Key features of the project



Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Jacobs 2015
 AUSIMAGE May 2014 and May 2015

Figure 3-1b Key features of the project

3.2.2 Interchanges

Black Hill

The Black Hill interchange would be located south of the John Renshaw Drive and Weakleys Drive roundabout, at Black Hill. The interchange would provide motorists with a northbound exit to the John Renshaw Drive and Weakleys Drive roundabout, and a southbound entrance from John Renshaw Drive and Weakleys Drive roundabout.

New England Highway

The New England Highway interchange would be located near the existing New England Highway/Anderson Road interchange, south of Tarro. The interchange would provide motorists with a northbound entrance onto the M1 Pacific Motorway from the New England Highway and John Renshaw Drive at Tarro. The interchange would also provide motorists with a southbound exit from the M1 Pacific Motorway to the New England Highway and John Renshaw Drive.

Tomago

The Tomago interchange is located between Tomago Road and Old Punt Road at Tomago. The interchange would provide motorists with a northbound entrance to the M1 Pacific Motorway from the A1 Pacific Highway west of Tomago Road. A southbound exit from the M1 Pacific Motorway would connect to the A1 Pacific Highway and Old Punt Road intersection. A northbound entrance and exit and a southbound entrance to the M1 Pacific Motorway would also be provided via a link road connecting to new intersections at Old Punt Road and Tomago Road.

Raymond Terrace

The Raymond Terrace interchange would be located east of Adelaide Street, Heatherbrae. The interchange would provide southbound motorists with an exit to the A1 Pacific Highway. Northbound motorists from the M1 Pacific Motorway are provided an exit to the A1 Pacific Highway.

3.2.3 Bridges, viaducts and retaining walls

The project would require a series of bridge structures, viaducts and retaining walls to provide grade separated interchanges, to maintain connectivity of existing local roads and to span over waterways, wetlands and floodplains.

The main bridges along the alignment would be located over Purgatory Creek, the Hunter River, Windeyers Creek and the New England Highway. The type of bridge for each crossing would be developed as the design progresses, with consideration given to the project's urban design, visual, environmental and economic objectives.

The viaduct that crosses the Hunter River floodplain would be about 2.6 kilometres long. The length of the viaduct would be confirmed as the design is progressed, with consideration of flood mitigation requirements and topography. This viaduct would be a single bridge structure providing for both carriageways. The viaduct includes a bridge section about 500 metres over the Hunter River and would provide appropriate maritime navigational clearances.

3.2.4 Embankments and cuttings

The project would involve the excavation, processing, transport and stockpiling of large quantities of earthworks. Embankments would support overpasses, bridges,

culverts and other structures. In areas where a bridge is not required, embankments would raise the level of the road pavement to meet flood immunity objectives for the project. The project would mostly be on fill, with one major cutting at Black Hill.

3.2.5 *Other ancillary features*

Construction ancillary facilities and activities would be required to support the construction of the project. The project may involve the following ancillary works:

- Ancillary construction facilities and activities, including:
 - Temporary sediment and erosion control measures and other environmental controls
 - Temporary signage
 - Construction compounds and stockpiles
 - Batching plants
 - Temporary property access arrangements and road diversions.
- Adjustments to utilities located in the proposed project site, including:
 - Chichester Trunk Gravity Water Main
 - TransGrid high voltage transmission lines and stanchions
 - Tomago to Hexham high pressure gas pipeline
 - Easement for the Stratford to Tomago pipeline, both owned and operated by AGL.
- Construction of drainage systems within the project site
- Relocation or provision of transport information systems (eg variable message signs and associated gantry structures)
- Corridor boundary fencing and fauna fencing, if required
- Noise mitigation works such as noise mounds, if required
- Landscaping and revegetation works.

Areas of soft soil where fill embankments would be placed would be treated before construction. Treatment of soft soils would involve two potential options:

- Pre-loading of material and use of wick drainage (this can be carried out prior to main construction)
- Structurally supported embankments and other engineered solutions

These ground treatments and any associated impacts resulting from the method selected would be described and addressed within the EIS.

The location and size of ancillary construction facilities would be developed as part of the concept design and EIS. In determining these facilities, existing land use activities, potential environmental impacts and amenity impacts on the surrounding community would be taken into account.

4 Key environmental issues

4.1 Overview

This chapter provides a preliminary assessment of the potential environmental impacts of the project based on the current level of design available. Some impacts may change as the design progresses and more detail becomes available. These changes would be considered as the environmental impact assessment process continues and the EIS is prepared.

The environmental issues have been classified as either 'key' or 'other' issues. The classification was based on the findings of preliminary investigations carried out for the project, and experience with similar projects. The assessment methodology typically included a database review (including previous studies), field survey and consideration of consultation feedback from stakeholders.

Key issues are those that may have high or moderate impacts (actual or perceived) and further detailed assessment is necessary to confirm the level of potential impact and to develop appropriate measures to mitigate and manage the impacts.

The outcomes of the preliminary environmental investigations indicate the following key environmental issues:

- Hydrology and flooding
- Groundwater and surface water
- Biodiversity
- Aboriginal cultural heritage
- Traffic and transport
- Noise and vibration
- Landscape character and visual amenity.

A number of other environmental issues have also been identified. These include:

- Land use and property
- Socio-economic
- Non-Aboriginal heritage
- Soils and contamination
- Air quality
- Greenhouse gas and climate change
- Waste and resource management
- Hazards and risks.

These other environmental issues are outlined in Chapter 5 and are considered to be of lesser consequence taking into consideration the project scope, the existing environment and the implementation of standard safeguards and management measures. It is expected that these other environment issues would not likely be key issues. However the potential impact of these other environmental issues would be assessed further in the EIS for the project.

4.2 Hydrology and flooding

4.2.1 Overview

Flood catchment

The project traverses the Hunter River floodplain within the lower reaches of the river system, as shown in **Figure 4-1**. The Hunter River catchment covers an area of 22,000 square kilometres and is a major river in NSW. The lower reaches of the Hunter River are tidal, forming the Hunter River estuary. Three major rivers discharge into the estuary, namely the Hunter River, the Paterson River and the Williams River. The confluence of the Williams River and the Hunter River is at Raymond Terrace. Within the study area, the Hunter River has numerous tributaries and other minor waterways including Purgatory Creek, Windeyers Creek, Grahamstown Drain, and Viney Creek. The catchment is predominantly agricultural upstream of Hexham, interspersed by a number of urban centres.

Flood behaviour

The majority of the study area is located within land affected by the one per cent AEP flood event, as per council zoning (refer to **Figure 4-1**). The AEP relates to the chance of a flood of a given size (or larger) occurring in any one year, usually expressed as a percentage.

Flooding on the lower reaches of the Hunter River floodplain is a result of both mainstream flooding from the Hunter River, and local catchment runoff. The Williams River joins the Hunter River about one kilometre upstream of Raymond Terrace. The combined waters of these two rivers then flow in a south-westerly direction, traversing the floodplain. The floodplain within the study area varies in width from about seven kilometres between Heatherbrae and Thornton to 2.5 kilometres between Tarro and Tomago. The Hunter River along this reach, from Raymond Terrace to Hexham Bridge is generally bounded by levee banks, with overbank flooding occurring on the low lying areas around Raymond Terrace.

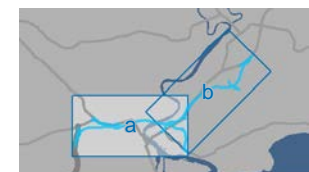
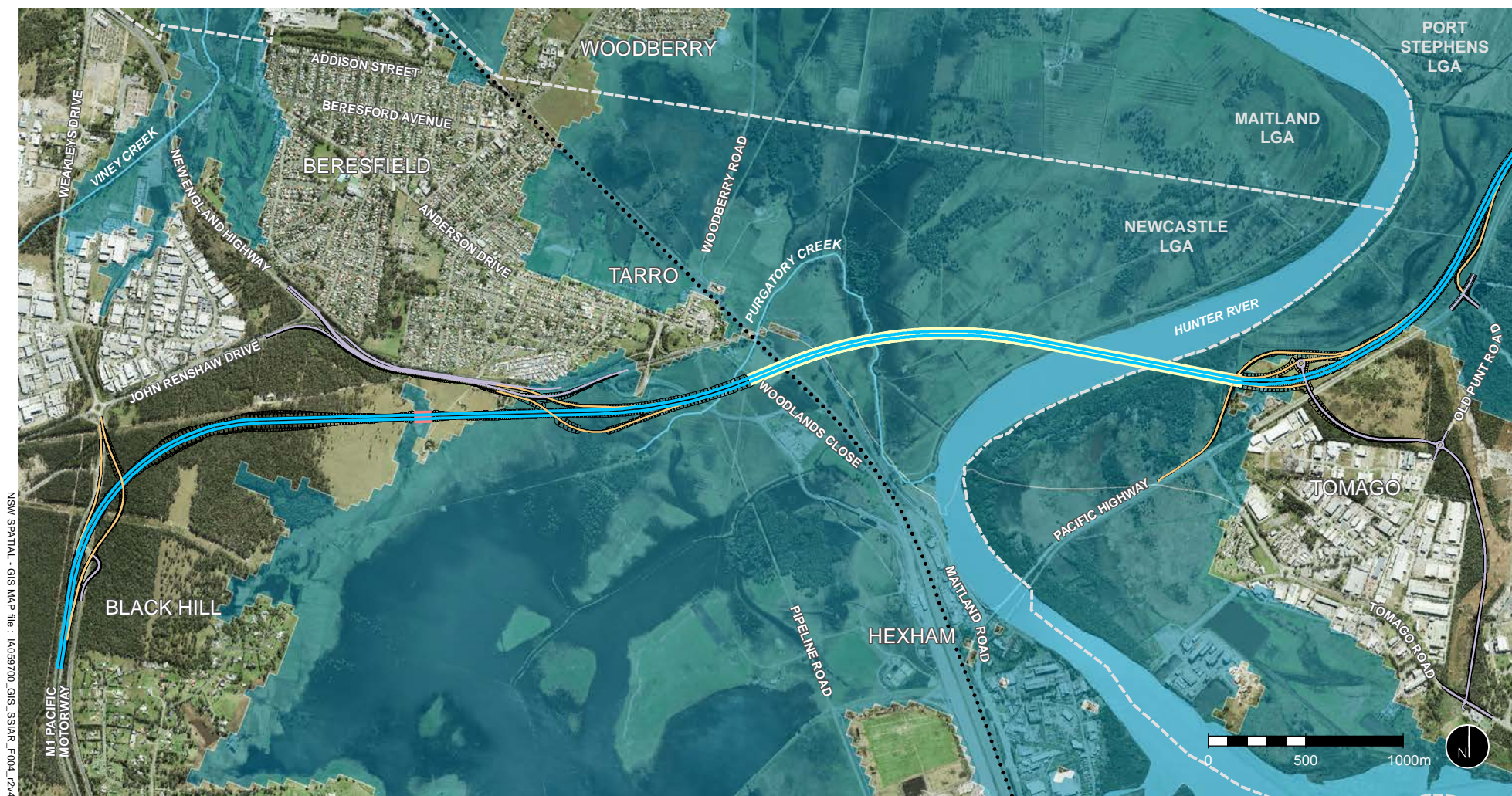
Windeyers Creek is a prominent tributary of the Hunter River which the project crosses at the most northern extent. During flood events, the Windeyers Creek catchment experiences flooding in low lying areas from the local catchment and/or from backwater from the Hunter River.

When the western levee bank of the Hunter River is overtopped, a substantially larger area of the Hunter River floodplain is inundated. This broad and wide floodplain therefore extends as far as Thornton. The Hunter River floodplain is then constricted between Woodberry and Heatherbrae as the Hunter River begins to meander west. Floodwaters are able to expand again and fill the floodplain to Beresfield in the west and overtop the existing A1 Pacific Highway to extend into areas north of Tomago. The floodplain is then constricted again between Tarro and Tomago, in the areas where the project is located. Floodwater can then overtop the existing New England Highway and fill the large floodplain storage area of the Hexham Swamp.

The Hunter River has experienced many floods during its history, with the largest flood occurring in 1955 (prior to official recording). The peak water level recorded in the Williams River at Raymond Terrace during the April 2015 east-coast low storm event, was 3.0 metres Australian Height Datum (AHD) which is similar to the five per cent AEP event. During this same event, the gauge in the Hunter River at

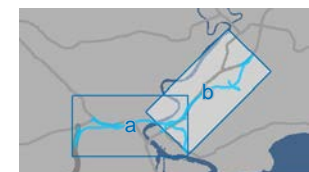
Hexham reached a peak water level of 1.8 metres AHD (similar to the 10 per cent AEP event).

Based on preliminary flood modelling carried out to inform the concept design development in 2015, the level of the existing A1 Pacific Highway was found to be below the five per cent AEP flood level in several locations within the project area, affording a low level of flood immunity for the highway in those areas (refer to **Figure 4-1**).



Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Jacobs 2015
 AUSIMAGE May 2014 and May 2015

Figure 4-1a Flood extents within study area (1% Annual Exceedance Probability)



Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Jacobs 2015
 AUSIMAGE May 2014 and May 2015

Figure 4-1b Flood extents within study area (1% Annual Exceedance Probability)

4.2.2 *Summary of issues*

Construction

- Potential increased flood levels and changes to drainage patterns due to the installation of temporary construction compounds and construction activities located on the floodplain
- Potential impacts to existing flow regimes due to the construction of earthen embankments for the surcharging of soft soils
- A large flood of the Hunter River occurring during construction would have the potential to impact construction works
- Temporary waterway crossings would likely be required, which would have potential impacts on flow regimes.

Operation

- Depending on the type of new bridge structures or culverts required, there would be potential afflux impacts during a flood event, as the bridges would be new structures in the Hunter River floodplain
- Infrastructure such as viaducts, bridges and embankments and modifications to waterways, may potentially change the velocity, location and magnitude of floods and flood characteristics including the time of inundation, depths and rates of recession
- Property, infrastructure, natural resources and agricultural land uses near the project may experience increased flood impact
- Climate change may increase the severity of rainfall and flood events, which exacerbates the current risk of flooding
- Concentrated surface flows may lead to erosion and scour of waterways and could affect habitats dependent on surface water flows
- Improved flood immunity and traffic network resilience during flood events would be a beneficial outcome of the project.

4.2.3 *Proposed further assessments*

A hydrology and flooding impact assessment would be prepared as part of the EIS and would:

- Describe the existing flood and drainage conditions in relevant catchments, taking into account commercial, agricultural and natural resource land use
- Establish existing flood levels and velocities for a range of design storm events
- Identify minimum road elevations, sizing of bridges and culverts, to achieve flood immunity objectives for the project
- Identify hydrological impacts for a range of design storm events, including the five per cent, one per cent, 0.05 per cent AEP storms and the probable maximum flood
- Identify potential impacts from changes in flooding characteristics on properties and structures
- Assess hydrological changes with consideration to changing weather patterns and increases in sea level as a result of climate change
- Provide input into the concept design to ensure the design meets the project objective of providing minimum 20 year (five per cent) AEP flood immunity for both carriageways, and identify feasible and reasonable mitigation measures to minimise impacts to flooding on surrounding areas.

4.3 Groundwater and surface water

4.3.1 Overview

Groundwater

Three groundwater systems have been designated by the NSW Office of Water within the study area, divided by the Hunter River, as listed below:

- The western side of the Hunter River is the coastal alluvial floodplain within the Newcastle Water Source of the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009*
- Above the floodplain to the north-west is porous rock of the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources* (currently in draft)
- The eastern side of the Hunter River is coastal sands within the Tomago Groundwater Source of the *Water Sharing Plan for the Tomago Tomaree Stockton Groundwater Sources 2003*.

The NSW Office of Water has designated each of these water sources as highly productive and therefore Level 1 Minimal Impact Considerations (Alluvial Water Sources and Coastal Sands) would be relevant to the project.

A number of active extraction bores have been identified within one kilometre of the project site from a search of the NSW Office of Water's PINNENNA database. The uses include monitoring bores, domestic bores and drinking water wells. The locations of these bores are shown in **Figure 4-2**.

Of the vegetation communities identified within the study area (refer to **section 4.4.1**), most have been identified as groundwater dependent ecosystems. High priority groundwater dependant ecosystems have also been identified in schedules of the relevant Water Sharing Plans for the study area. Those identified include Environmental Planning Policy No.14 Coastal Wetlands (SEPP 14) in the study area, in addition to Wetland Vegetation, Swamp Forest and Swamp Heath Woodland native vegetation communities.

Tomago Sandbeds Catchment Area

The Tomago Sandbeds Catchment Area is an underground water source (aquifer) operated by the Hunter Water Corporation. The catchment is also classified as a special area under the *Hunter Water Act 1991* to protect it as a drinking water supply. The area covers about 100 square kilometres and provides about 20 per cent of the Lower Hunter's drinking water. The sandbeds are located parallel to the coast between Newcastle and Port Stephens, starting at Tomago and extending northeast for about 25 kilometres to Lemon Tree Passage.

The sandbeds consist of a layer of highly permeable fine grained sands underlain by impervious clay and rock. The thickness of the sand layer reaches a maximum of 50 metres, but on average is 20 metres deep. The sandbeds are strategically important for both ongoing and backup drinking water supply. Ongoing supply from the sandbeds reduces the load on surface water sources being Chichester Dam and Grahamstown Dam, and thereby allows greater overall yield from the total Lower Hunter water supply system.

Water from the Tomago aquifer is good quality with the sand acting as a filter of contaminants. Most land within the Tomago Sandbeds Catchment Area is protected,

which minimises activities that could degrade water quality for this underground water source (Hunter Water, 2014).

An extensive system of underground bores and vacuum stations draw raw water from the sandbeds to surface well heads and provides Hunter Water Corporation access to about 60,000 megalitres for the Lower Hunter water supply. The Hunter Water Corporation draws this water using existing infrastructure from a portion of Tomago Sandbeds (Hunter Water, 2014). Some of these bore well heads are located near the project (refer to **Figure 4-2**).

Surface water

The project alignment would cross the Hunter River, Purgatory Creek, Windeyers Creek, Grahamstown Drain and Viney Creek (refer to **Figure 4-2**). There are extensive areas of wetland registered under SEPP 14 in the northern parts of Hexham Swamp and along the eastern and western banks of the Hunter River. At least two wetlands (SEPP 14 No. 832 and SEPP 14 No. 830) would be crossed by the project within the Hunter River floodplain.

A review of water quality studies in the Hunter River (Sanderson and Redden, 2001) was undertaken for the preliminary environmental investigations in September 2014 and indicated that the Hunter River:

- Experienced elevated levels of nutrients (nitrogen and phosphorus) and chlorophyll-a
- Experienced turbidity levels higher than the Australian and New Zealand Guidelines for Fresh Marine Water Quality guidelines (ANZECC/ARMCANZ, 2000)
- Experienced relatively good dissolved oxygen levels, although, also indicated that the biological community may have been stressed for a period of time
- Generally met ANZECC guidelines for secondary contact recreation for faecal coliforms (excluding enterococci), however, generally did not meet the guidelines for primary contact.

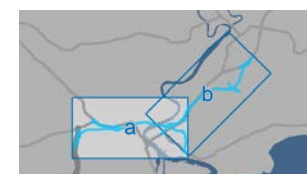
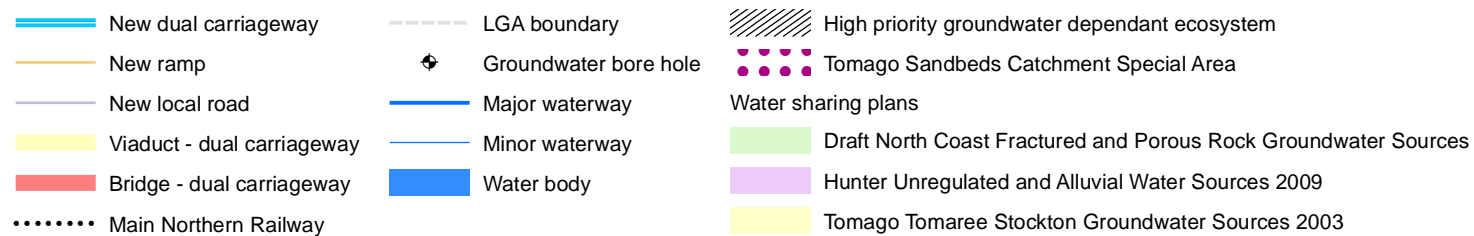
These watercourses are sensitive receiving environments that drain either directly into the Hunter River or nearby wetland systems. Many of the receiving waters for the project drain to or support sensitive aquatic and riparian environments, including aquatic ecosystems and fish habitat (refer to **section 4.4.1**). A number of State significant and RAMSAR wetlands are located to the south of the project. This includes the Hunter Estuary Wetlands, which is a RAMSAR listed wetland, located about one kilometre south-east of the project. Other wetlands are listed as a nationally important for their suitability as habitat for nationally listed threatened species (eg Hunter Wetland National Park and Hexham Swamp located two kilometres downstream).

NSW Aquifer Interference Policy

It has been identified that the project would constitute an Aquifer Interference Activity under the Water Management Act 2000 due to the potential requirement for consolidation of soft soils and the interruption of shallow groundwater flow. The project would therefore be required to assess potential changes on groundwater levels and quality. In particular, where the project is located in close proximity to the SEPP14 wetlands, and other high-priority groundwater dependent ecosystems, as specified in the schedules of the relevant Water Sharing Plans. Potential impacts on flow and quality from accelerated consolidation methods (such as vertical drains) to

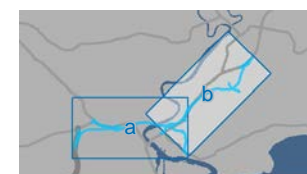
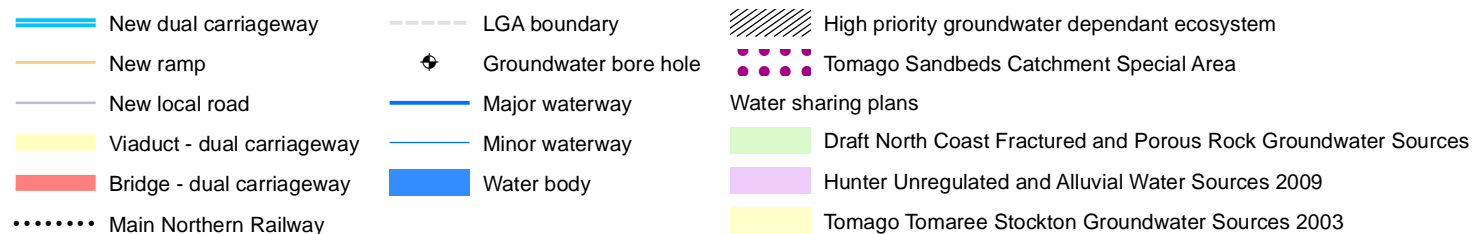
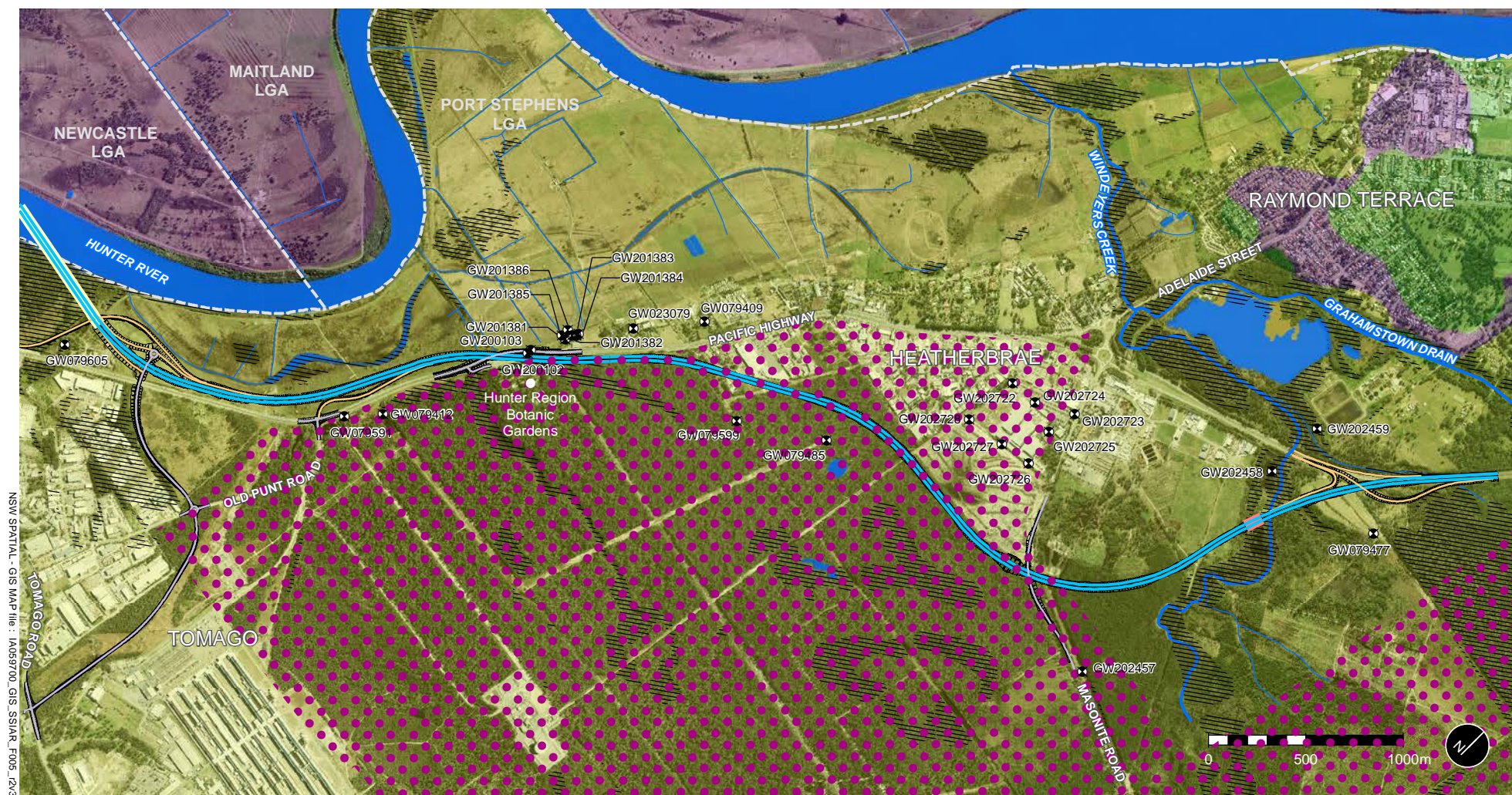
enhance the connectivity of soft soils to the underlying sand alluvium would be assessed and potential mitigation measures prescribed.

The underlying sand alluvium layers below the Holocene era soft soils are anticipated to be in hydraulic connection with the Tomago Sandbeds, and any potential impacts to this groundwater source need to be assessed and potential mitigation measures prescribed.



Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Hunter Water
 Jacobs 2015
 AUSIMAGE May 2014 and May 2015

Figure 4-2a Surface and groundwater resources near the project



Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Hunter Water
 Jacobs 2015
 AUSIMAGE May 2014 and May 2015

Figure 4-2b Surface and groundwater resources near the project

4.3.2 *Summary of issues*

Construction

- Potential impacts on groundwater dependent ecosystems due to changes in the flow, quantity and quality of groundwater
- Potential for localised drawdown of groundwater resources due to dewatering during construction
- Potential for groundwater contamination if construction activity intersects with groundwater (eg through accidental fuel and chemical spills)
- Exposure of acid sulfate soils (as a result of earthworks or dewatering), which may result in acidification of waterways and groundwater sources and the mobilisation of heavy metals in the environment
- Potential impacts to infrastructure serving the Tomago Sandbeds Catchment Area.

Operation

- Potential impacts on groundwater dependent ecosystems due to changes in the flow, quantity and quality of groundwater
- Potential impacts on surface water or groundwater movements and drainage patterns
- Potential impacts on groundwater flow regimes and water quality within the Tomago Sandbeds Catchment Area (drinking water aquifer).

4.3.3 *Proposed further assessments*

An assessment of the potential impacts to groundwater and surface water for the project would be undertaken and would:

- Review the borehole logs from existing and additional monitoring wells, and other relevant baseline conditions for groundwater level and quality. This review would assist in identifying the local groundwater system and hydro-geochemical environment
- Identify the ground conditions for embankments, earthworks and excavation. This would include an assessment of the expected impact to groundwater quality and flow as a result of the project
- Identify the impact of the project on the groundwater system. The methodology used to quantify groundwater impacts would be determined in consultation with the NSW Office of Water.
- Review the concept design and recommend measures should the project have a potential to substantially change groundwater levels or flows or affect the quality of groundwater sources.

4.4 Biodiversity

4.4.1 Overview

A review of previous studies and database records was used to inform a targeted field survey in February 2015. The following provides a summary of the previous study, database search and targeted survey findings.

4.4.2 Vegetation communities

A review of database records has identified 12 vegetation communities located near the project, including.

- Alluvial Woodland
- Blackbutt-Apple-Bloodwood Forest
- Botanic Gardens (canopy only)
- Coastal Saltmarsh
- Freshwater Wetlands
- Lower Hunter Spotted Gum Ironbark Forest
- Mangrove Woodland
- Paperbark-Apple-Swamp Mahogany Forest
- Pine Plantation
- Planted vegetation
- Swamp Oak Floodplain Forest
- Swamp Sclerophyll Forest.

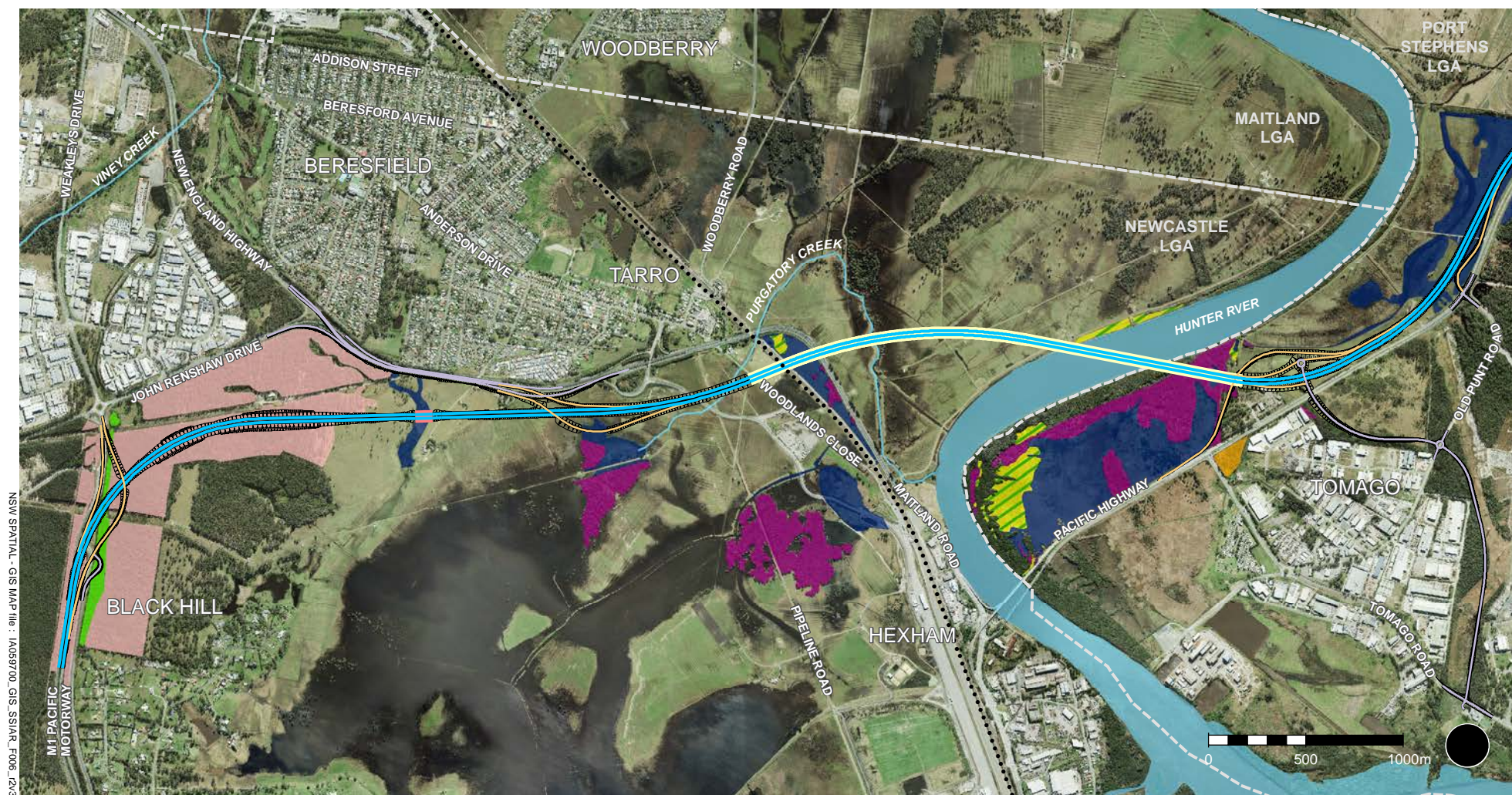
Threatened ecological communities

Targeted field surveys of the project conducted by Jacobs in February 2015, identified six native vegetation communities listed as 'threatened ecological communities' under the *State Threatened Species Conservation Act 1995* (TSC Act). One of these (Coastal Saltmarsh), is also listed under the *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

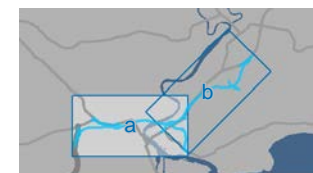
These communities are shown in **Figure 4-3** and include:

- Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions (listed as Subtropical and Temperate Coastal Saltmarsh on EPBC Act)
- Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions
- Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion
- River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

A Mangrove-Estuarine Complex community (Grey Mangrove low closed forest) listed under the *Fisheries Management Act 1994* was also identified. The Mangrove-Estuarine Complex is equivalent to the Subtropical and Temperate Coastal Saltmarsh (included above), which is listed as a vulnerable threatened ecological community under the EPBC Act (refer to **Figure 4-3**).

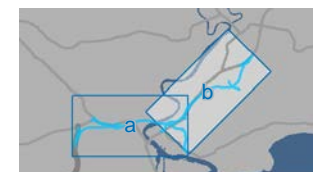
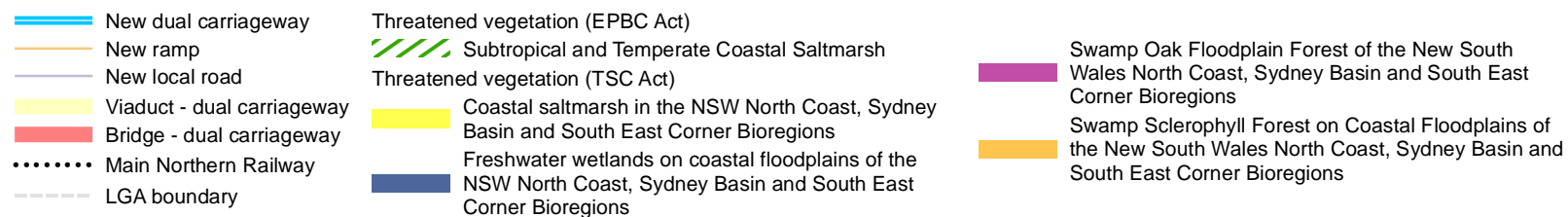


- | | | |
|----------------------------|--|---|
| New dual carriageway | Threatened vegetation (EPBC Act) | Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion |
| New ramp | Subtropical and Temperate Coastal Saltmarsh | River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions |
| New local road | Threatened vegetation (TSC Act) | Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions |
| Viaduct - dual carriageway | Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions | Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions |
| Bridge - dual carriageway | Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions | |
| Main Northern Railway | | |
| LGA boundary | | |



Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Jacobs 2015
 AUSIMAGE May 2014 and May 2015

Figure 4-3a Threatened ecological communities identified within the study area



Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Jacobs 2015
 AUSIMAGE May 2014 and May 2015

Figure 4-3b Threatened ecological communities identified within the study area

Coastal wetlands and waterway systems

Two SEPP 14 coastal wetlands would be directly impacted by project (refer to **Figure 4-4**). These include SEPP 14 No. 832 and SEPP 14 No. 830. Both these wetlands are categorised as high priority groundwater dependant ecosystems within Water Sharing Plans for the region (refer to **section 4.3.1**), in terms of their sensitivity to water quality changes and sensitivity to groundwater changes.

In addition to the SEPP 14 listed wetlands, there are three other waterways and riparian habitats traversed by the project, including the:

- Hunter River
- Purgatory Creek (which flows into the Hunter River and crosses the project at two locations near Tarro)
- Windeyers Creek (which flows into the Hunter River and crosses the project at the furthest north end of the project).

These waterways are identified as key fish habitat and would likely correspond to a Class 1 or Class 2 waterway (Fairfull and Witheridge, 2003), providing important flora and fauna habitats.

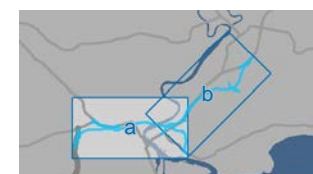
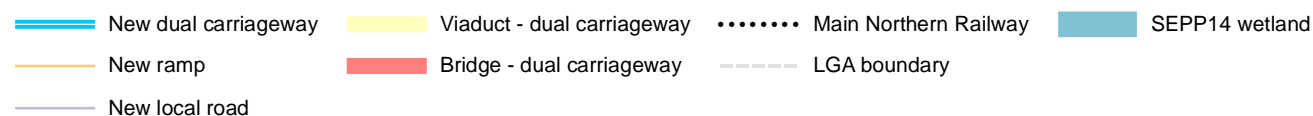
Threatened flora and fauna species

The study area contains potential habitat for a number of threatened flora and fauna species. A search of the NSW BioNet Atlas of Wildlife database on 27 July 2015 indicated that 10 threatened flora or fungi species and 60 threatened fauna species have been recorded or are predicted to occur within 10 kilometres of the project (refer to Appendix B). However, not all of these species would have suitable habitat within the study area. Some species such as *Grevillea parviflora* and *Callistemon linearifolius* are known to be located within the project site.

In addition, a search of the EPBC Act protected matters search tool on 6 July 2015 indicated that 58 listed threatened species or species habitat (or habitat which provides for foraging, feeding or related behaviour) were either known to occur, may occur, or likely to occur within 10 kilometres of the project (refer to Appendix B).

Migratory species

A search of the EPBC Act protected matters search tool on 6 July 2015 identified that 61 listed migratory species or species habitat (or habitat which provides for foraging, feeding or related behaviour) may occur or were likely to occur within 10 kilometres of the project (refer to Appendix B). In addition, potential habitat for wetland birds and migratory waders (shorebirds) has been identified at Windeyers Creek located east of Heatherbrae (Biosis Research, 2005).

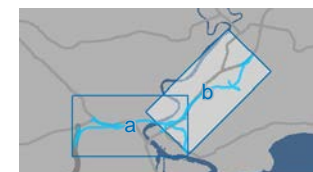


Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Jacobs 2015
 Department of Planning and
 Environment
 AUSIMAGE May 2014 and May 2015

Figure 4-4a Wetlands near the project



- New dual carriageway
- Viaduct - dual carriageway
- Main Northern Railway
- SEPP14 wetland
- New ramp
- Bridge - dual carriageway
- - - - - LGA boundary
- New local road



Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Jacobs 2015
 Department of Planning and Environment
 AUSIMAGE May 2014 and May 2015

Figure 4-4b Wetlands near the project

Fauna habitat

The project site and the study area host a range of resources for threatened fauna species. All of the vegetation communities and wetlands noted in the above sections provide habitat for State and Commonwealth listed threatened species.

With respect to the Koala (*Phascolarctos cinereus*), the project and nearby areas includes suitable Koala habitat attributes, as mapped by the Lower Hunter Koala Study (Eco-Logical Australia, 2013). These include:

- Areas of high Koala habitat value
- Areas with moderate and high abundance of primary Koala feed trees (these are the preferred feed trees)
- Areas with moderate and high abundance of secondary Koala feed trees (occasional feed tree (seasonal), less frequent).

These areas are typically located between Tomago and Raymond Terrace. Notably, one of the remaining stands of primary feed trees for Koala (Forest Red Gum (*Eucalyptus tereticornis*)) is located north of the Tomago industrial estate and has the potential to be impacted by the project.

There are areas of high conservation value foraging habitat within the study area for the Grey-headed Flying-Fox (*Pteropus poliocephalus*). These are particularly concentrated around the Black Hill forested areas and to the east of Tomago and Heatherbrae within the Tomago Sandbeds Catchment Area. Both these locations are intersected by the project and would remove habitat for this species.

Wildlife corridors

Wildlife corridors are links of native vegetation that join two or more areas of similar habitat, and are critical for sustaining ecological processes, such as provision for animal movement and the maintenance of genetically viable populations.

The study area bisects a State significant wildlife corridor identified by the Lower Hunter Regional Conservation Plan (DECCW, 2009), which extends from the Watagan Ranges, through Hexham Swamp to Port Stephens. The corridor is a broad strategic 'green' corridor rather than one designed for a particular species. The project runs parallel to this corridor, making access and connectivity perpendicular to the corridor important.

Specifically for the project, fauna connectivity is likely to be important in the areas around the crossing of Windeyers Creek with fauna using this area to access habitats in the upper reaches of the Hunter River.

4.4.3 Summary of issues

The project would directly impact existing biodiversity within the project site. The main direct impact would be associated with the removal of vegetation, in particular, the removal of threatened ecological communities, and habitat for threatened species including areas of habitat value for Koala. The project would also potentially indirectly impact on important wetlands, key fish habitat and other aquatic and riparian habitats within the study area.

Construction

- Of the threatened ecological communities identified, the project would directly impact on Freshwater Wetlands on Coastal Floodplains and Swamp Oak Floodplain, Coastal Saltmarsh and Lower Hunter Spotted Gum – Ironbark Forest
- Native vegetation, ecological communities, threatened flora and fauna species, and their habitats listed under the TSC Act or EPBC Act could be indirectly impacted as a result of native vegetation fragmentation, edge effects, changes in hydrology and the spread of weeds
- Areas of high habitat value for Koala (*Phascolarctos cinereus*) and high conservation value foraging habitat for Grey-headed Flying-Fox (*Pteropus poliocephalus*) could potentially be impacted by native vegetation clearing
- SEPP 14 wetlands, key fish habitat, and other aquatic and riparian habitats would potentially be impacted by clearing, modification to waterways, changes to water chemistry, increased shading, and obstruction to fish passage
- Wildlife corridors could be directly and indirectly impacted by vegetation clearing
- Trees that may provide potential habitat for threatened fauna species (for example microchiropteran bats or Grey-headed Flying Foxes) would be cleared.

Operation

- The movement of threatened fauna species would potentially be directly or indirectly impacted by the introduction of a barrier to movement (such as road embankments and infrastructure)
- Aquatic and riparian habitats would potentially be directly or indirectly impacted as a result of hydrological changes.

4.4.4 Proposed further assessments

During the development of the design and the preparation of the EIS, further opportunities to avoid and minimise impacts to areas of ecological value will be explored. Roads and Maritime will carry out an assessment of impact on the ecological values of the project site and adjoining areas including terrestrial, riparian and aquatic areas. The assessment will be prepared in accordance with the Framework for Biodiversity Assessment (FBA) (OEH 2014b) and the Biodiversity Offsets Policy for Major Projects (OEH 2014c) by a person accredited in accordance with Section 142B(1)(c) of the TSC Act.

Should offsets be required, a Biodiversity Offsetting strategy will also be prepared.

Preparation of the EIS will include consideration of potential impacts to aquatic and wetland areas, and wildlife corridors.

If a potential significant impact on nationally listed biodiversity is identified during assessment of the project, Roads and Maritime will first endeavour to avoid that impact. However, if it is unavoidable then Roads and Maritime will initiate a referral to the Australian Government, which may then trigger application of the NSW Bilateral Agreement with respect to environmental assessment.

4.5 Aboriginal cultural heritage

4.5.1 Overview

The project traverses the traditional lands of the Awabakal language group west of the Hunter River and the Worimi language group on the eastern side. They are recognised and acknowledged as the traditional custodians of the land and waters of the Lower Hunter region.

The study area is located within the boundary of the Mindaribba Local Aboriginal Land Council (LALC) and the Worimi LALC. Roads and Maritime has consulted with the Mindaribba and Worimi LALCs in accordance with stage two of the *Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI)* (Roads and Maritime, 2011).

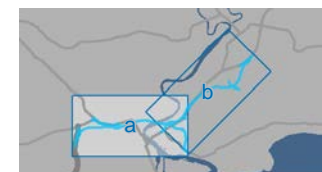
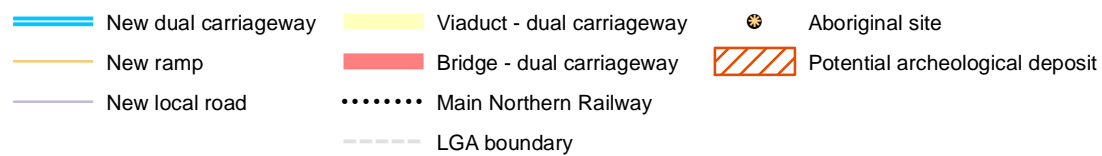
There have been many archaeological investigations carried out within the study area for various utility and infrastructure proposals. In 2006, a preliminary Aboriginal archaeological survey and assessment was prepared to assess options and constraints across the study area (Reeves 2006). These studies have provided much information regarding occupation of the land and would be used to assess the detailed impact of the project.

A search of the Aboriginal Heritage Information System (AHIMS) during preliminary environmental investigations prepared in September 2014 identified numerous registered Aboriginal sites located near the project (refer to **Figure 4-5**).

In 2015, Roads and Maritime conducted an Aboriginal archaeological survey and assessment of the project site. This was in accordance with stage two of Roads and Maritime PACHCI.

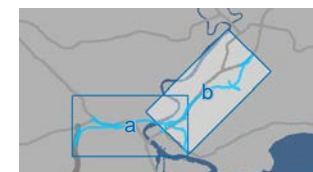
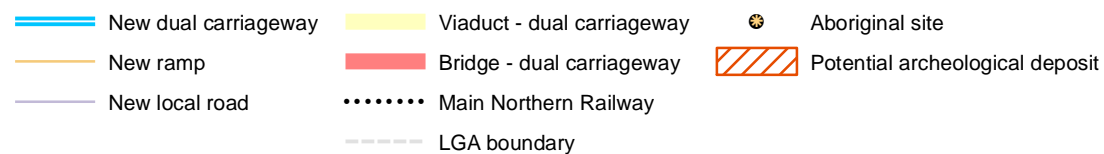
The western portion of the project site (near Black Hill) contains a large quantity of Aboriginal archaeological material. This includes four potential archaeological deposits (PAD) (refer to **Figure 4-5**). Black Hill is considered to have high archaeological potential and cultural sensitivity. The eastern portion of the project site is also likely to contain Aboriginal archaeological material, due to the remnant dune deposits of the Tomago Sand Sheet. The Tomago Sandbeds are considered to have moderate archaeological potential and cultural sensitivity. The Hunter River floodplain is considered to have low archaeological potential and cultural sensitivity because these areas were seldom occupied and river processes have largely reduced deposition and preservation of archaeological materials.

There are no declared Aboriginal places within the vicinity of the project. A search of the National Native Title Register was carried out on 13 January 2015 to identify registered native title claimants or native title holders for the study area. This search identified that there were no native title claimants or native title holders for the project.



Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Jacobs 2015
 Office of Environment and Heritage
 AUSIMAGE May 2014 and May 2015

Figure 4-5a Registered Aboriginal sites and potential archaeological deposits near the project



Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Jacobs 2015
 Office of Environment and Heritage
 AUSIMAGE May 2014 and May 2015

Figure 4-5b Registered Aboriginal sites and potential archaeological deposits near the project

4.5.2 Summary of issues

Construction

- Direct and/or indirect impact to registered Aboriginal sites or PADs due to the construction of the project
- Direct and/or indirect impacts to unknown Aboriginal sites due to construction activities being carried out in areas of high and moderate archaeological potential and sensitivity.

Operation

Once the project is operating, the presence of the project may indirectly impact on any intrinsic Aboriginal cultural values of the area and any existing or potential Aboriginal sites within close proximity to the project.

4.5.3 Proposed further assessments

Roads and Maritime will prepare an Aboriginal Cultural Heritage Assessment Report in line with Roads and Maritime PACHCI stage three during the preparation of the EIS. The assessment will also be carried out in accordance with the requirements of the:

- *Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010)*
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010a)*
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (DECCW, 2010b).*

The assessment will:

- Summarise the findings and recommendations of the stage two PACHCI Archaeological Survey Report previously carried out and update information as required
- Continue consultation with the local Aboriginal community, including the Mindaribba and Worimi LALC
- Identify and investigate the Aboriginal archaeological and cultural heritage values that are known or are predicted to be present by undertaking additional field survey, test excavations and consultation with the registered Aboriginal stakeholders and Aboriginal knowledge holders as required
- Assess the potential impacts, on Aboriginal archaeological and cultural heritage values, including intangible cultural values
- Identify potential safeguards and management measures to reduce the impact of the project on Aboriginal cultural heritage
- Provide recommendations on any further archaeological work that may be required prior to construction.

4.6 Traffic and transport

4.6.1 Overview

Access and connectivity

Roads within the study area play a key role in facilitating transport and connectivity within the Lower Hunter. State roads in the area such as John Renshaw Drive, Weakleys Drive and Tomago Road, together with the New England Highway and Pacific Highway provide connectivity between local centres such as Beresfield, Tarro, Hexham, Tomago, Heatherbrae and Raymond Terrace. The Raymond Terrace bypass and the M1 Pacific Motorway, as well as the Main North Rail Line, make up an important north-south travel corridor through the Hunter region. East-west movements are facilitated by the Hunter Valley rail network, the New England Highway and the Golden Highway (NSW Government, 2014c).

Together, the A1 Pacific Highway, New England Highway, Hunter Expressway, John Renshaw Drive and Tomago Road provide access to important destinations including the City of Newcastle, Port of Newcastle, Newcastle Airport, Upper Hunter Valley mining developments, Maitland and other major employment and commercial centres in the Hunter Region. The urban arterial sections of the New England Highway and A1 Pacific Highway through the project area form part of the National Land Transport Network, and make up part of the Sydney to Brisbane road link (DIRD, 2015).

Key intersections and interchanges within the study area are at:

- The M1 Pacific Motorway, John Renshaw Drive and Weakleys Drive intersection: This intersection provides northbound access via Weakleys Drive to Thornton, Beresfield and Maitland, westbound access to the Hunter, New England and Central West regions of NSW via the Hunter Expressway to the New England and Golden Highways and southbound access to Newcastle and Sydney via the M1 Pacific Motorway
- John Renshaw Drive on ramp onto New England Highway: This intersection provides access to the New England Highway and then onto Newcastle via the A1 Pacific Highway east bound and to northern New South Wales and Queensland northbound
- New England Highway off ramp to John Renshaw Drive: This intersection provides access to Sydney and southern NSW via the M1 Pacific Motorway southbound, as well as access to the Hunter Valley to the west via the Hunter Expressway
- New England Highway and Weakleys Drive interchange: The grade separated interchange provides access to Tarro, Beresfield, Woodberry and Thornton.
- A1 Pacific Highway and New England Highway intersection: This intersection at Hexham Bridge facilitates northbound and southbound movements. Northbound access is to Raymond Terrace, the north coast of New South Wales and Queensland while southbound access is provided to Newcastle, Sydney and Southern NSW via the A1 Pacific Highway and M1 Motorway.
- A1 Pacific Highway and Tomago Road intersection: This intersection provides access to the Tomago employment area, Newcastle airport, Williamstown RAAF Base and regional coastal lands
- A1 Pacific Highway, Adelaide Street and Masonite Road intersection: This intersection provides westbound access to Raymond Terrace via Adelaide Street, while Masonite Road provides access from the A1 Pacific Highway to local industrial developments and coastal hinterland
- Old Punt Road and A1 Pacific Highway intersection: Old Punt Road is a local collector road, about two kilometres in length, running between the A1 Pacific

Highway in the north to Tomago Road in the south. The road has a single lane in each direction and provides access to the Tomago employment area. This intersection provides for northbound movements from the Tomago area as the Tomago Road intersection with the Pacific Highway does not allow this movement.

Traffic volumes and traffic flow

Traffic volumes on the M1 Pacific Motorway just south of John Renshaw Drive recorded average daily traffic volumes of about 34,000 vehicles in 2014. About 21 per cent of these vehicles are heavy vehicles. An investigation into the hourly traffic pattern indicated evening peak is slightly higher than the morning peak. The highest peak hour traffic volume was recorded at between eight per cent and nine per cent of daily traffic.

The New England Highway is the east-west corridor within the study area. Traffic volumes on the New England Highway increase from about 40,000 vehicles per day at Maitland to about 60,000 vehicles per day west of the Hunter River Bridge within the study area. About 13 per cent of these vehicles are heavy vehicles. Between Maitland and Newcastle the daily profile along the New England Highway exhibits a conventional morning and evening peak pattern, with the peaks occurring at about 8am and 5pm respectively. Traffic volumes between peak periods remain comparatively high as a proportion of total flow, which shows that this section of the corridor has heavy commuter use, but also a high level of local traffic throughout the day.

John Renshaw Drive is a key east-west corridor in the study area linking the Hunter Expressway, the townships of Kurri Kurri and Cessnock with the M1 Pacific Motorway and New England Highway. Since the opening of the Hunter Expressway this route has taken on a greater strategic importance through its interchange at Buchanan. John Renshaw Drive via its interchange with the Hunter Expressway provides a key route from the Upper Hunter to the Port of Newcastle and central business district.

John Renshaw Drive carries average daily traffic volumes of about 12,000 vehicles per day west of the M1 Pacific Motorway and Weakleys Drive intersection and about 32,500 vehicles per day just west of the New England Highway.

Weakleys Drive is a single carriageway road with generally one lane in each direction for most of its length, which acts as a connector from the M1 Pacific Motorway to the New England Highway. Land near Weakleys Drive has recently been developed with light industrial and commercial uses. Weakleys Drive carries average daily traffic of about 20,000 vehicles per day north of John Renshaw Drive.

The A1 Pacific Highway within the study area is about a seven kilometre long section between the Hexham Bridge across the Hunter River and the southern end of the Raymond Terrace Bypass at Masonite Road. Tomago Road is a key intersection along this section of the highway, as it connects employment areas along its length as well as the Newcastle Regional Airport and Royal Australian Air Force Base at Williamstown. The A1 Pacific Highway carries average daily traffic of about 50,000 vehicles per day just north of the Hexham Bridge. Of this traffic, about 15 per cent are heavy vehicles.

The key traffic flow characteristics within the study area are:

- Heavy eastbound and westbound traffic along the New England Highway, Maitland Road and A1 Pacific Highway during morning and afternoon peak periods.
- A large proportion of traffic from the M1 Pacific Motorway travels toward Newcastle and the A1 Pacific Highway via John Renshaw Drive and the New England Highway as an alternative to using the Newcastle Link Road from the M1 Pacific Motorway at the M1 Motorway/John Renshaw Drive intersection. This traffic movement contributes to congestion during morning and afternoon peak periods on the New England Highway
- Substantial delays are experienced at the intersection of the New England Highway and A1 Pacific Highway at Hexham during morning and afternoon peak periods. The high traffic demands on the New England Highway, combined with the relatively high traffic demand southbound on the A1 Pacific Highway, at the signalised intersection result in queuing and delays to all movements at this location
- High volumes of traffic during traditional holiday periods travel between the M1 Pacific Motorway and the A1 Pacific Highway via John Renshaw Drive, the New England Highway and existing Hexham Bridge
- Heavy traffic demands at the intersection of the A1 Pacific Highway and Tomago Road during morning and afternoon peak periods result in delays
- Moderate traffic movements along the A1 Pacific Highway through Heatherbrae and the A1 Pacific Highway, Masonite Road and Adelaide Street intersections during morning and afternoon peak periods result in minor delays.

Travel times

Travel time information has been collected for key routes within the study area. In the morning peak period, the travel time from the M1 Pacific Motorway to the A1 Pacific Highway at Heatherbrae is slightly shorter than the travel time from the New England Highway at Weakleys Drive to the same destination. Travel times for routes in the reverse direction are longer due to the traffic lights on the southern side of the Hexham Bridge. The additional delay is due to the heavy east-west movement on the New England Highway passing through this intersection.

Travel times in the evening peak are similar to the morning peak. The southbound movement from Heatherbrae to either the M1 Pacific Motorway or the New England Highway at Weakleys Drive is longer than the northbound movement due to the additional delays experienced at the traffic lights at the New England Highway and A1 Pacific Highway intersection at the southern side of the Hexham Bridge.

Public transport

The existing road and rail network supports local, regional and international freight transport including transport to and from the Port of Newcastle, which is the largest bulk shipping port on the east coast of Australia, catering to the world's leading coal exporter.

Rail infrastructure within the study area also provides passenger capacity within the Hunter Region. The Main North Rail Line within the study area is located between Tarro and Hexham with stations at Beresfield, Tarro and Hexham.

Other public transport services include local and regional bus services that connect Newcastle, the Hunter Valley, Port Stephens and other regional towns within NSW.

Pedestrian and cyclist facilities

As indicated in the *Newcastle Cycling Strategy and Action Plan* (Newcastle City Council, 2012), there are a number of existing and proposed on and off road cyclist facilities within the Newcastle local government areas (LGAs).

There is a growing network of off-road shared pathways throughout the Lower Hunter region (Lower Hunter Transport Guide, 2013). Off-road shared pathways are generally located within or near the urban centres and central business districts.

Freight transport

The Lower Hunter, due to its geographical location and existing transport hubs of the Port of Newcastle and RAAF Base Williamtown/Newcastle Airport, has an important role to play in the movement of freight throughout NSW; and of Australia as a whole. Maximising these opportunities is important for the continued economic growth of the region.

The existing road and rail network provides important links for freight transport, with a substantial proportion of this traffic being heavy vehicles on the M1 Pacific Motorway (about 21 per cent) and the New England Highway (about 13 per cent).

In addition to the road network noted above, the existing rail infrastructure including the Main North Rail Line, provides substantial freight capacity as well as passenger capacity, to and from the Hunter region. The Main North Rail Line transects the project between Tarro and Hexham (refer to **Figure 3-1**).

The Hunter Regional Transport Plan (NSW Government, 2014b) identifies the need to ensure the efficient movement of freight within the Hunter region. The project has been identified as a medium to long-term initiative in the *NSW Long Term Transport Master Plan* (NSW Government, 2012b) to provide an important link for freight.

Crash history

Table 4-1 shows the number of crashes recorded in the study area during the five year reporting period between July 2009 to June 2014. The New England Highway and the A1 Pacific Highway recorded the highest number of crashes (as they are the longest lengths and have higher traffic volumes compared to the other sections). Tomago Road and Old Punt Road recorded the lowest number of crashes.

Table 4-1 Crashes recorded within the study area during the five year reporting period between July 2009 and June 2014

Road	Section	Fatal	Injury	Non-Casualty (Tow-away)	Total
John Renshaw Drive	500 m west of M1 Pacific Motorway to New England Highway	0	31	56	87
M1 Pacific Motorway	North of Black Hill to John Renshaw Drive	0	40	44	84
New England Highway	West of Thornton Rd to Old Maitland Road	3	132	223	355

Road	Section	Fatal	Injury	Non-Casualty (Tow-away)	Total
Old Punt Road	Tomago Road to Pacific Highway	0	10	8	18
A1 Pacific Highway	New England Highway to Richardson Road	3	103	133	236
Tomago Road	500 m west of Tomago Aluminium to Pacific Highway	0	21	21	42
Weakleys Drive	John Renshaw Drive to New England Highway	0	47	69	116

Note: As some sections of the road network within the study area overlap, some crashes which have occurred at intersections have been recorded in two sections of road.

4.6.2 Summary of issues

Construction

Due to the location of large sections of the project offline from the existing highways and away from local access roads, construction of the majority of the project is unlikely to cause substantial disruption to the local traffic network. However, traffic disruptions would occur during works associated with modification of the intersections where they connect into the project interchanges.

Other issues that may result from the project during construction include:

- Reduced performance of the surrounding road network from the introduction of vehicles movements or temporary land/road closures
- Adverse impacts on public transport services and operations during construction
- Adverse impacts on rail infrastructure during construction
- Changed traffic conditions potentially leading to accidents
- Temporary adjustment to private property access.

Operation

During operation, the project is likely to result in a reduction of congestion on the surrounding road network and the local and regional communities would benefit from improvements to travel times, traffic congestion and road safety.

In addition there may be permanent adjustment to some private property access and local and regional roads.

4.6.3 Proposed further assessments

A detailed traffic and transport assessment of the project would be carried out during the preparation of the EIS. The assessment would include:

- An assessment of the existing and future traffic and transport environment, including a description of the local and regional road network, speed environment, parking and access arrangements within the study area, provision for public transport and changes to pedestrian and cyclist facilities

- An overview of the construction phase impacts, including likely construction traffic volumes, peak volume periods, haulage routes, construction parking requirements and locations, temporary changes to accesses
- An assessment of traffic and transport changes resulting from potential staged delivery of the project
- Road safety analysis.

Appropriate safeguards and management measures to reduce the impact of the project on traffic and transport would be identified within the assessment.

4.7 Noise and vibration

4.7.1 Overview

Traffic noise is the dominant noise source at residential dwellings located along the Pacific and New England Highway corridors. Industrial and commercial operations within business parks also contribute to the background noise levels, particularly in the vicinity of Tomago and Heatherbrae. Other noise sources include the Main North Rail Line operations, the Hexham rail relief facility, shipping using the Hunter River and aircraft arriving and leaving RAAF Base Williamtown – Newcastle Airport.

A number of sensitive receivers have been identified within 300 metres of the project. Locations which contain high numbers of sensitive receivers in the study area include:

- Cahill Close, near Black Hill
- Low density residential area at Tarro (adjacent to the New England Highway)
- General industrial area near Tomago Road, at Tomago
- Pacific Gardens Mobile Home Village at Heatherbrae (near the A1 Pacific Highway)
- Heavy industrial area, near New England Highway.

Roads and Maritime would be applying 'extended working hours' for construction work to occur outside of standard working hours noted in the NSW Interim Construction Noise Guideline (DECC, 2009). Working hours would be extended by two hours each weekday and by four hours on Saturday, with the following working hours to be proposed in the EIS:

- Monday to Friday 6am to 7pm
- Saturday 8am to 5pm.

Approval of longer working days would ensure delivery of the project benefits as soon as possible. In particular, it would:

- Result in a direct increase in productivity across the project, making maximum and most efficient use of existing equipment and resources
- Potentially cause less disruption to the community, local business, motorists, pedestrians and cyclists as work could be completed earlier
- Potentially bring forward the opening date for the project by increasing the allowable construction hours.

The assessment of construction noise to be carried out in the EIS would assume the extended working hours noted above. The proposed construction hours and consideration of the effects would be discussed with the community before construction.

4.7.2 Summary of issues

Construction

- Potential exceedance of construction noise criteria at sensitive receiver locations (particularly where construction activities would be undertaken outside of standard working hours)
- Potential noise from ancillary sites (physical activities eg batching plants, material handling sites, stockpiling, compounds)

- Vibration-generating construction equipment could cause annoyance to building occupants and potential damage to nearby structures (including heritage items).

Operation

- Potential exceedance of noise and vibration criteria at residential receiver locations.

4.7.3 Proposed further assessments

A noise and vibration assessment will be carried out during the preparation of the EIS. The assessment will include:

- Identification of sensitive receivers near the project who may be affected by noise and vibration impacts during construction and operation
- Selection of relevant operational noise criteria in accordance with the NSW's Road Noise Policy (EPA, 2011) and with reference to Roads and Maritime's Noise Criteria Guideline (Roads and Maritime, 2015) and Environmental Noise Management Manual (RTA, 2001)
- An assessment of the potential for the project to exceed the relevant noise and vibration criteria during construction or operation in accordance with the Road Noise Policy (EPA, 2011) and NSW Interim Construction Noise Guideline (DECC, 2009), including an assessment of the proposed extended working hours for construction
- Identification of appropriate safeguards and management measures to reduce the impact of the project on noise and vibration during construction and operation as per the NSW Interim Construction Noise Guideline and Noise Mitigation Guideline (Roads and Maritime, 2015).

4.8 Landscape character and visual amenity

4.8.1 Overview

The study area is characterised by a diverse range of landscape character types including woodland, pasture, arable land, floodplain, ridgelines and foothills, interspersed with pockets of residential and commercial development. Six landscape character zones have been identified within the study area. These include:

- Black Hill/Woods Gully forest
- Hexham/Tomago Industrial Estates
- Hunter River floodplain
- Hunter floodplain forest
- Heatherbrae/Raymond Terrace
- Tarro/Beresfield.

These zones comprise a combination of landscape character types and land uses that are considered typical components of a peri-urban region consisting of residential, commercial/industrial, agricultural and natural landscape features.

The visual setting of the study area is primarily influenced by the Hunter River and its floodplain which divides the study area. The undulating profile of Black Hill to the west, rolls into the flat, relatively low lying landform of the Hunter River floodplains. This open floodplain comprises of rural properties. A network of watercourses intersects the landscape. To the north of the study area, the farm sizes increase with open grazing paddocks and scattered trees.

Wetland and moist woodlands are scattered through the area, creating a patchwork of textures and colours. The Hexham Swamp Nature Reserve is a key habitat for endemic flora and fauna.

Crossing the Hunter River, a clear transition is experienced from open floodplain to the dense woodland, with wide views north-west across the floodplain pasture land. The settlements of Heatherbrae and Raymond Terrace run parallel to the river and tend to be linear forms located between the river to the north and forested land to the south.

Visual catchments include areas where the project would be visible from eye level. Visual catchments are influenced by landform, vegetation and built environments. The visual catchment of the project would generally comprise residential areas located near the road corridor (such as at Tarro and Beresfield), road users of the existing road alignment, and areas with views of the major project features (such as the cutting at Black Hill, and the viaduct over the Hunter River).

4.8.2 Summary of issues

Construction

- Visual impacts associated with construction activities (including temporary fencing, signage, light spill, and construction machinery). These impacts would be greater for residential areas located close to construction activities such as at Beresfield, Tarro and Heatherbrae
- Changes to landscape amenity associated with construction activities near natural assets (such as wetlands, bushland areas, and the Hunter River)
- Visual impacts associated with the removal of vegetation

Operation

- Introduction of visual features into a sensitive landscape including the viaduct over the Hunter River, cutting at Black Hill and new road infrastructure. These visual features have the potential to impact aesthetic values and landscape amenity within the surrounding area
- Changes to the landscape character, from scenic and primarily rural landscapes with limited development, to a motorway
- Impacts on views for residences surrounding the project and road users using the motorway, including views of new road infrastructure, bridges, structures and ramps
- Changes to landscape amenity near natural assets, such as the Hunter River and associated wetlands and bushland areas
- Visual impacts associated with tourist activities along the Hunter River.

4.8.3 Proposed further assessments

A detailed assessment of landscape character and visual impacts will be undertaken in accordance with Roads and Maritime Environmental Impact Assessment Guidance Note EIA-N04 Guidelines for landscape character and visual impact assessment (Roads and Maritime, 2013a). The assessment will provide:

- Identification of landscape character zones and key representative viewpoints within the project site
- An assessment of the visual sensitivity of each landscape character zone and key representative viewpoints, as well as the nature and scale of the project within each zone

- A review of the impacts of the project on each landscape character zone and key representative viewpoint during construction and operation
- Development of an urban design strategy to avoid and minimise landscape character and visual impacts to be integrated with the overall design of the project, including structures and landscape design outcomes
- Identification of appropriate safeguards and management measures to reduce the visual impact of the project during construction and operation.

5 Other environmental issues

5.1 Overview

Other environmental issues listed below are considered to be of lesser consequence to those included in Chapter 4, taking into account the scope of the project, the existing environment and the implementation of standard and best practice management and mitigation measures. It is considered unlikely that these would be key issues for the project; however, further assessment would be carried out as part of any future EIS for the project as detailed below. Any environmental safeguards and management measures required to minimise and mitigate impacts would be documented as part of the EIS.

5.2 Land use and property

5.2.1 Overview

Land zoning

There are various land uses within the vicinity of the project, including industrial, commercial and retail, agricultural, residential (including a number of caravan parks) and conservation. The project is located within a number of different land zones listed on the Newcastle and Port Stephens LEPs. These are listed below and are shown in **Figure 5-1**.

- Newcastle LEP:
 - SP2 Infrastructure (Classified Road)
 - E4 Environmental Living
 - E2 Environmental Conservation
 - W2 Recreational Waterways
- Port Stephens LEP:
 - SP1 Special Activities (Tomago Sandbeds Catchment Area)
 - SP2 Infrastructure (Classified Road)
 - RU2 Rural Landscape
 - E2 Environmental Conservation
 - IN1 General Industrial.

A road corridor for the project was gazetted in both LEPs as SP2 Infrastructure (Classified Road). The gazetted road corridor within these LEPs crossed the Hunter River south of the proposed alignment. Since the LEP corridor was originally gazetted, there has been some change in land use, although not substantial. This has mainly focused on the infilling of established commercial areas including the Heatherbrae economic corridor /bulky goods zone.

Residential areas are typically low density detached dwellings on large lots. The main residential areas are within Black Hill, Beresfield, and Heatherbrae; and at Tarro where the density is at its greatest.

Industrial and commercial

Industrial and commercial land uses are located at Beresfield, Hexham, Black Hill, Tomago, and Heatherbrae and have are identified as major employment opportunity areas within the Newcastle and Port Stephens LGA.

In mid-2013, 183 hectares of land were rezoned at Black Hill for employment purposes. This is the area near the intersection of the M1 Pacific Motorway and John Renshaw Drive. This area is expected to deliver up to 3,600 full-time jobs, supporting a further 9,000 indirect jobs in the wider economy (Department of Planning and Infrastructure, 2013).

The Beresfield Industrial Area is Newcastle's only greenfield industrial area. It is located near the study area on the New England Highway and Weakleys Drive and consists of 288 hectares of light industrial zoned land. The southern half of the industrial area has been rapidly developed over the past five years, accommodating a variety of industrial uses. The Local Planning Strategy Working Paper: Centres and Employment Lands notes that Beresfield Industrial Area is a major employment generating area (Newcastle City Council, 2013).

The Port Stephens Planning Strategy 2011-2036 (Port Stephens Council, 2011) notes that due to its isolation from residential areas, the Tomago industrial area is particularly suitable for heavy industrial uses. The need to maintain and improve transport access, especially Tomago Road, is identified as a key issue in this strategy. Floor space demand is forecast to increase by between 65,000 and 280,000 square metres (depending on the modelling scenario) between 2009 and 2031.

In Heatherbrae, commercial and retail land uses are located on either side of the existing A1 Pacific Highway (although businesses are generally consolidated along the eastern side of the A1 Pacific Highway).

Utilities

The major utilities and services that occur within, across, or are located near the project include:

- **Electrical:** Several major overhead transmission lines (132 kV) traverse the project north of the Tomago interchange. This transmission line would be impacted by the project carriageway and potentially the Tomago interchange ramps. TransGrid own and operate the West Wallsend to Tomago 330 kV transmission line (Feeder 82/95) which crosses the project at Black Hill, across the Hunter floodplain, and at the Tomago interchange. At one location over the floodplain, the transmission line stanchions would need to be raised in order to achieve the necessary vertical clearance over the viaduct
- **Water:** Hunter Water owns the water services in the project site. The project would impact the existing and proposed upgrade of the Hunter Water Chichester Trunk Gravity Main. The project would potentially require the relocation of this water main
- **Gas:** AGL own and operate the Tomago to Hexham high pressure gas pipeline which is in the vicinity of the project site. Additionally, AGL have easement approval for the Stratford to Tomago pipeline ensuring that no construction takes place on this pipeline route without approval. The project would require construction across this easement and may require approval from AGL.

Agricultural

Important agricultural land uses as defined within the Lower Hunter Regional Strategy (Department of Planning, 2006) near the project include:

- Beef cattle (Class 4) (including other livestock grazing) located in the western portion of the project, near Black Hill, and south of the existing A1 Pacific Highway, near Tomago
- Broadacre agriculture (Class 1) (including dairy cattle) located north and south of the existing A1 Pacific Highway, near Tarro
- Viticulture (Class 4) (including fruit and nut orchards) located in the western portion of the project, near Black Hill.

These agricultural land uses would have reliance on secondary features of the study area such as farm dams, flood mitigation channels, evacuation routes, and flood refuge areas, all or some of which may be affected by the project.

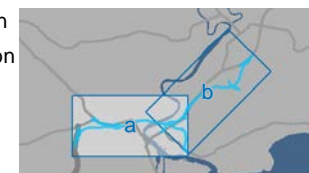
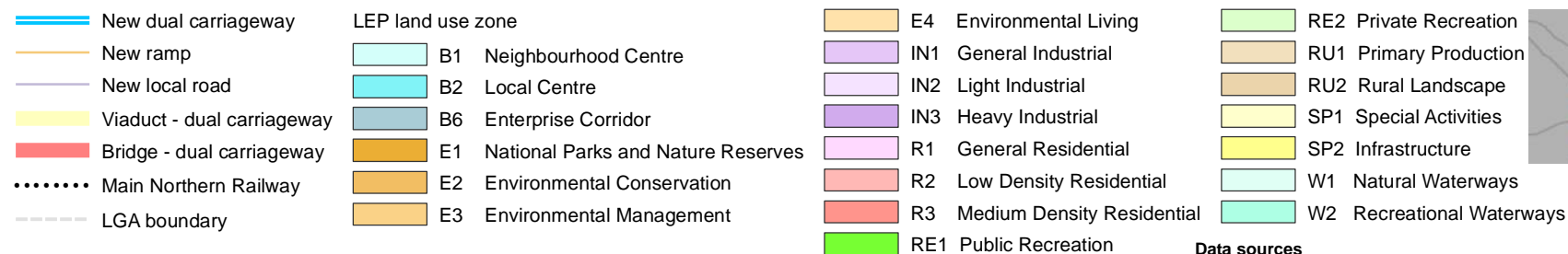
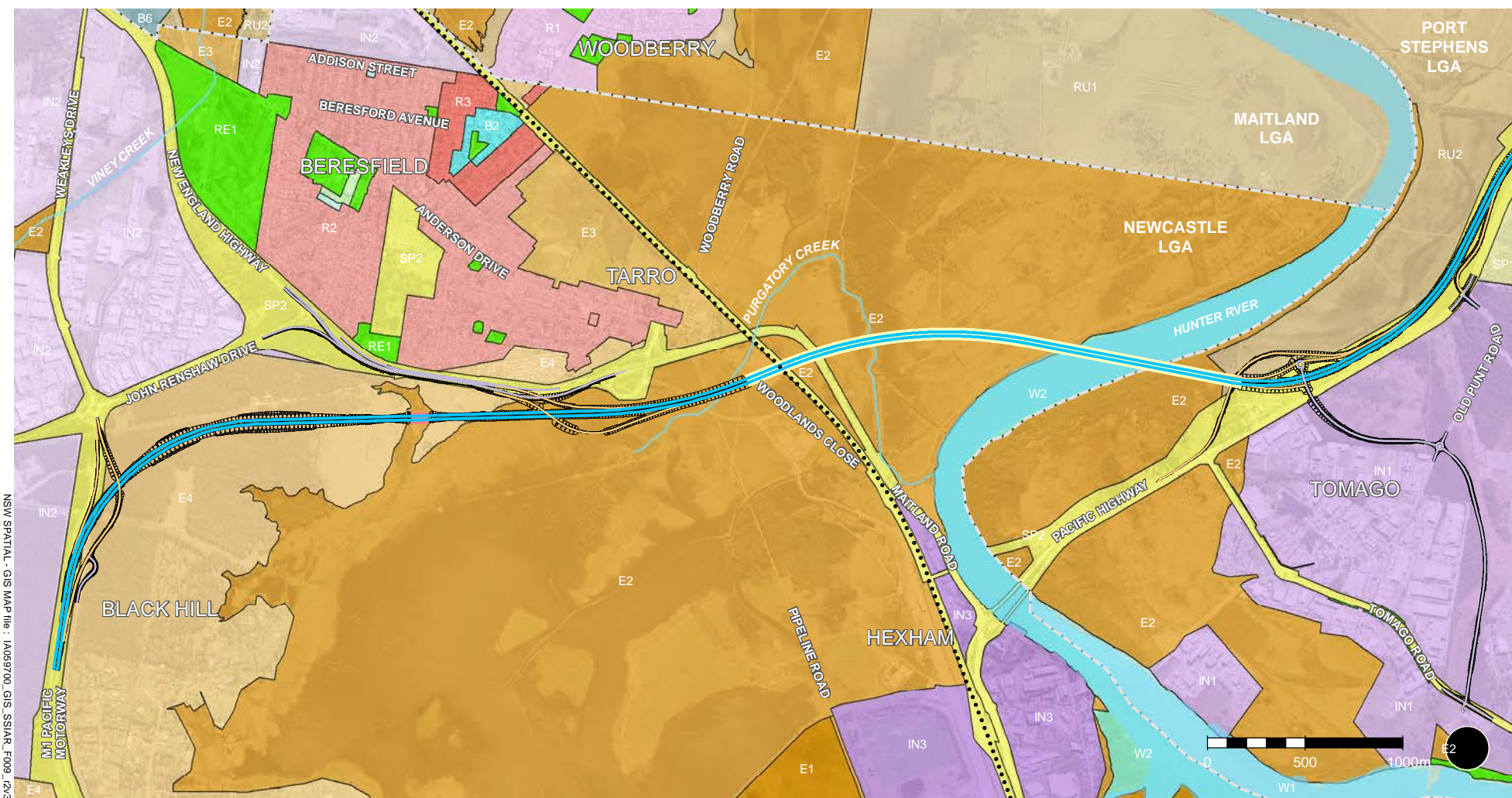


Figure 5-1a Land use zones on the Newcastle, Maitland and Port Stephens LEP

Data sources
Roads and Maritime Services 2015, Land and Property Information 2014, Jacobs 2015, Department of Planning and Environment, AUSIMAGE May 2014 and May 2015, Newcastle LEP 2012, Maitland LEP 2011 and Port Stephens LEP 2013

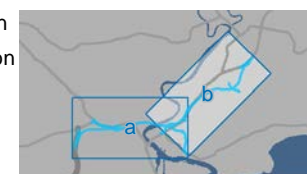
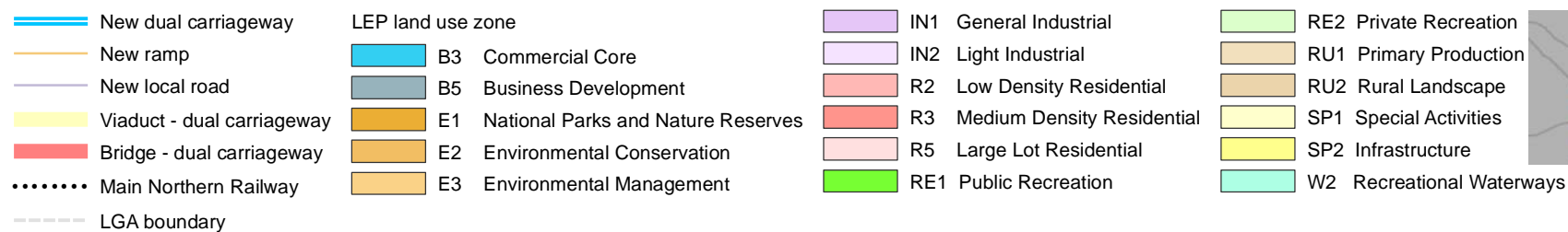
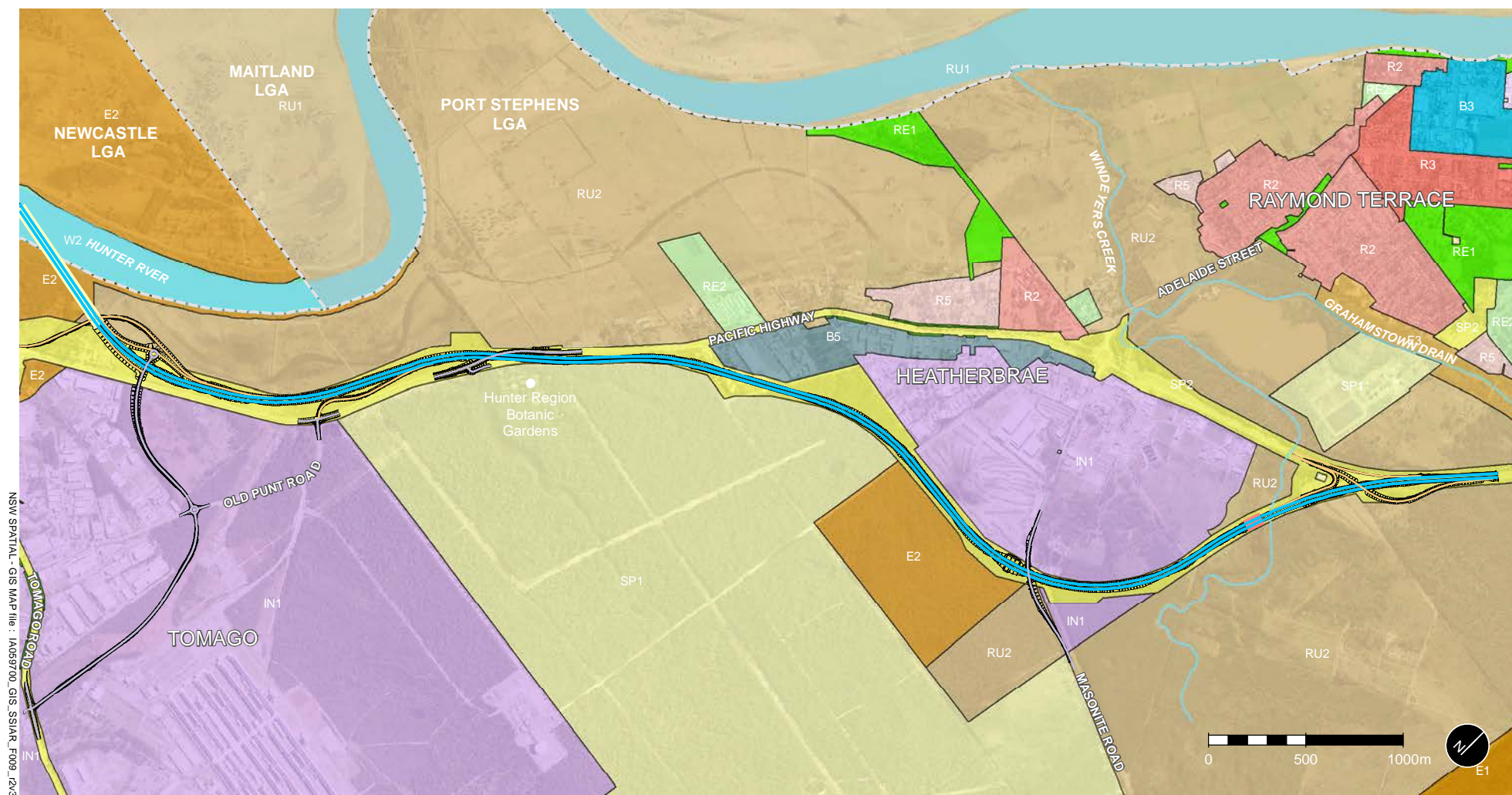


Figure 5-1b Land use zones on the Newcastle, Maitland and Port Stephens LEP

Data sources
 Roads and Maritime Services 2015, Land and Property Information 2014, Jacobs 2015, Department of Planning and Environment, AUSIMAGE May 2014 and May 2015, Newcastle LEP 2012, Maitland LEP 2011 and Port Stephens LEP 2013

5.2.2 Potential impacts

Construction

- Loss of important agricultural land (including land suitable for beef cattle, broadacre agriculture, and viticulture)
- Impacts to property related infrastructure (including storage sheds and fencing)
- Temporary adjustments to private property access
- Disruptions to major utility infrastructure
- Impacts on farm dams, flood mitigation channels, and flood refuge areas.

Operation

- Partial or full acquisition of private rural properties and commercial enterprises
- Changes to the use of agricultural land, fragmentation and severance of agricultural properties
- Changes in access arrangements to private property – commercial or residential
- Changes in land zoning on the relevant LEPs (such as land zoned for conservation, special activities, and industry, as well as the existing road corridor)
- Opportunities for an increase in the provision of employment generating land use that can take advantage of the new link between the M1 Pacific Motorway and the Raymond Terrace Bypass.

5.2.3 Proposed further assessment

Further assessment of potential land use impacts will be carried out during the preparation of the EIS. The assessment will include:

- A detailed description of the existing land use environment, including details of property ownership
- An assessment of potential impacts of the project on land use and property
- Identification of safeguards and management measures to reduce the impacts of the project on land use and property.

5.2.4 Safeguards and management measures

Land use and property impacts will be minimised through the implementation of standard safeguards and management measures. These would include:

- Refinement of the project to reduce the effect of the project on land-take and impacts on land which may reduce its beneficial reuse
- Consultation with affected property owners, including utility asset owners
- Maintenance of access to properties near the project. Where existing access cannot be maintained, temporary or permanent property access would be provided during construction and as required
- Management of property acquisition in accordance with the provisions of the Land Acquisition Policy (Roads and Maritime, 2012b) and the Land Acquisition (Just Terms Compensation) Act 1991.

5.3 Socio-economic

5.3.1 Overview

Social profile

The project is located within the Newcastle and Port Stephens Council LGAs. At 30 June 2014, Newcastle LGA had an estimated residential population of about 160,021 people, while Port Stephens LGA had an estimated residential population of about 69,728 people (ABS, 2015). Between 2004 and 2014, Newcastle LGA's residential population has grown at an average rate of about 1.0 per cent annually, marginally lower than NSW as a whole (at 1.23 per cent). Over the same period, residential population growth in Port Stephens LGA has been marginally higher than NSW, at 1.3 per cent. This trend is projected to continue over the 20 years to 2031.

Locally, the estimated residential population for the Beresfield-Hexham statistical area level 2 (SA2) and Raymond Terrace SA2 was 8,725 people and 14,505 people, respectively at 30 June 2014 (ABS, 2015). These areas experienced very low rates of population growth over the 10 years to 2014, at an average of 0.5 per cent or less annually.

The study area comprises a mix of land uses including residential, social infrastructure, industry, agriculture and conservation. Residential uses nearest to the project mainly comprise rural residential uses at Lenaghan and urban residential uses at Beresfield, Tarro and Heatherbrae. A number of houses are also located on larger farming properties at Black Hill and Tarro.

As discussed in **section 5.2**, industrial land uses are located at Beresfield, Hexham, Black Hill, Tomago, and Heatherbrae. These offer major employment opportunities for communities within the Newcastle and Port Stephens LGAs.

Commercial and retail uses are located at Heatherbrae, on either side of the existing A1 Pacific Highway, which serve the needs of people who live or work in the local area as well as regional communities and passing motorists. These include such places such as hotel/motels, takeaway and fast food outlets, service stations, home renovation and trade centres, motor vehicle, machinery, camping and caravan sales. Tourist accommodation uses are also located near to the project at Tarro and Hexham.

Key social infrastructure located near the project includes the Newcastle Memorial Park at Beresfield; education uses such as Tarro Public School near Anderson Drive at Tarro, and Hunter River High School at Heatherbrae; and Hunter Region Botanic Gardens located near the existing A1 Pacific Highway at Heatherbrae. The gardens are managed and maintained by volunteers and is an important attraction for residents and visitors to the Hunter Region. The Botanic Gardens offer education and research activities and hosts a range of exhibits, events and functions. A range of other, smaller community uses and facilities are also located within the centres and urban areas of Beresfield, Tarro and Heatherbrae.

The study area contains a number of natural features that are likely to be important to local and regional communities. These include the Hunter River and associated wetlands, as well as areas of important vegetation communities and habitats. The Hunter River extends from Liverpool Ranges to Newcastle and offers a range of environmental, amenity and recreational values for local and regional communities. The study area also includes rural and semi-rural landscapes that contribute to the

character and amenity of the area, and which are also likely to be valued by local communities.

5.3.2 *Potential impacts*

Construction

- Temporary changes to local amenity for communities closest to construction activities, particularly at Beresfield, Tarro and Heatherbrae, due to increased construction noise, dust and traffic. This includes potential impacts on night-time amenity where night-time works are required
- Delays and disruptions for the local community and motorists due to reduced speed limits temporary access changes and short-term lane closures near to construction activities
- Potential changes in access and impacts on amenity for users of the Hunter Region Botanic Gardens due to construction activities near the gardens
- Potential visual impacts and disruptions to access for commercial and recreational users of the Hunter River during the construction of the viaduct
- Potential impacts on community values associated with the area's natural assets such as wetland and bushland areas (eg environmental, landscape amenity, recreation and aesthetic values) due to construction activities within or near to the Hunter River and areas of conservation value
- Impacts to the local community and surrounding environment due to potential concurrent construction activities in the vicinity of the project.

The implementation of safeguards and management measures would assist in managing potential construction impacts on local and regional communities. Overall, construction impacts would be temporary in nature and relatively short-term in the context of the projects long-term operational benefits.

Operation

- Improved access and travel benefits for local and regional communities due to improved safety, reduced traffic volumes, and time travel improvements
- Improved regional access, supporting development of employment generating land uses within the study area, as well as improved access for local and regional communities to commercial and industrial uses at Beresfield, Hexham, Black Hill, Tomago, and Heatherbrae
- Changes in local access and connectivity and travel patterns for some residents and local communities due to changed access arrangements to the highway from private properties and local roads. Access would be maintained to the existing highway, which would support local movement and connectivity
- Access to the Hunter Region Botanic Gardens would be improved through the provision of the Tomago interchange, which would connect the project to the A1 Pacific Highway and Tomago Road
- Recreational access to the Hunter River would be maintained during operation, although establishment of a new bridge across the Hunter River may impact on community values associated with the river's landscape amenity and aesthetic values. Impact on natural areas within the project footprint is also likely to be a concern for some people
- Access to the Hunter River for commercial activities would be maintained during operation
- Potential impacts on local businesses and commercial uses in Heatherbrae would be dependent on the type and nature of individual businesses. Some businesses may be impacted by the diversion of traffic away from Heatherbrae and a reduction in passing traffic. Conversely, the reduction in through-traffic,

including trucks, would help to improve local amenity and road safety within Heatherbrae. This is likely to have a positive impact for some businesses, through improved access for local residents and support for new business functions, such as for tourism.

5.3.3 Proposed further assessment

A socio-economic impact assessment will be carried out during the preparation of the EIS. The socio-economic assessment would be carried out in accordance with Environmental Impact Assessment Practice Note – Socio-economic Assessment (EIA-N05) (Roads and Maritime, 2013b). The assessment will include:

- A description of the existing socio-economic environment for local and regional communities, including consideration of social characteristics (such as key population and demographic indicators, travel behaviour, families and housing), identification of places or features of community value, and economic characteristics (such as local business and industry, employment and income)
- An assessment of potential business impacts, particularly from the bypass of Heatherbrae town centre. This would consider the type and nature of existing businesses within the town centre and their likely dependence on the highway, and potential impacts associated with the bypass of the town centre
- Identification and assessment of potential socio-economic impacts associated with the construction and operation of the project, particularly changes in local amenity for residents closest to the project, impacts on places or features important to local communities, impacts on community uses such as the Hunter Region Botanic Garden and changes to local access and connectivity for motorists, pedestrians and cyclists
- Identification of potential safeguards and management measures to reduce the socio-economic impacts of the project
- Consultation with affected property owners, stakeholders and the local community.

5.3.4 Safeguards and management measures

Socio-economic impacts would be minimised through the implementation of standard safeguards and management measures, such as noise attenuation and dust mitigation measures, and traffic management strategies. This would include the preparation of a Communication Plan in accordance with the Stakeholder Engagement Toolkit (Roads and Maritime, 2015).

The plan would provide:

- A procedure to notify affected residents of the details and timing of proposed construction activities
- A procedure to notify nearby land users of changed conditions during the construction period (such as disruptions to traffic, pedestrian, or driveway access)
- A contact name and number for complaints, as well as an appropriate complaint handling procedure.

Other measures to manage potential socio-economic impacts would include:

- Ongoing consultation with identified stakeholders and business owners would be carried out to minimise impacts during the construction of the project
- Minimising impacts on places or features of community value through the detailed design phase.

5.4 Non-Aboriginal heritage

5.4.1 Overview

A search of the following heritage registers, databases and schedules was carried out during preliminary environmental investigations to identify heritage items in or near the study area:

- NSW State Heritage Inventory
- NSW State Heritage Register
- Roads and Maritime Heritage and Conservation Register
- Australian Heritage Database
- Australian Heritage Places Inventory

There are no items listed on the National Heritage List or State Heritage Register located in or near the project.

A search of the Newcastle LEP 2012, Maitland LEP 2011 and Port Stephens LEP 2013 identified thirteen heritage sites of local significance within about one kilometre of the project site. None of these heritage sites are located within the project site. The closest heritage site is a residence at Tarro (29 Eastern Avenue, Tarro). This site is located on the northern side of the New England corridor, about 50 metres from the project.

Sites identified within about one kilometre of the project site are identified in **Table 5-1** and shown on **Figure 5-2**.

Table 5-1 Listed heritage items located within about one kilometre of the project site

Item	Register listing(s)	Significance	Location	Lot/DP	Relationship to the project
Newcastle Crematorium	Newcastle LEP	Local	176 Anderson Drive, Beresfield	Lot 10, DP 1114807; Lot 17, DP 1140445; Lot 11, DP 553141	Located about 100 m north of the project
Beresfield Public School	Newcastle LEP	Local	181 Anderson Drive, Beresfield	Lot 1, DP 782678; Lot 1, DP 544214; Lots 182–184, 188 and 189, Section B, DP 12628	Located about 700 m north of the project
Residence	Newcastle LEP	Local	29 Eastern Avenue, Tarro	Lot 100, DP 849413	Located about 50 m north of the project
Tarro Community Hall	Newcastle LEP	Local	2A Northern Avenue, Tarro	Lot 3, Section F, DP 13126	Located about 250 m from the project
Our Lady of Lourdes	Newcastle LEP	Local	42 Anderson Drive, Tarro	Lot 42, DP 1096998	Located about 300 m

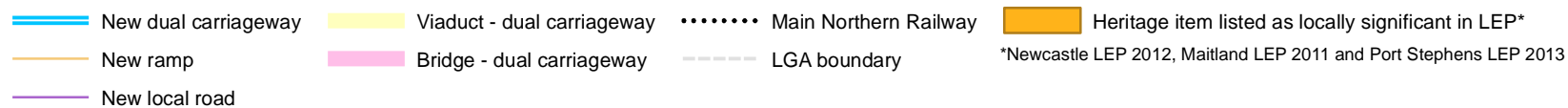
Item	Register listing(s)	Significance	Location	Lot/DP	Relationship to the project
Church					from the project
Tarro Substation	Newcastle LEP	Local	3 Woodberry Road, Tarro	Lot 2, DP 595526	Located about 300 m from the project
Tarro Pumping Station	Newcastle LEP	Local	3 Woodberry Road, Tarro	Lot 2, DP 595526	Located about 300 m from the project
Hexham Shipbuilding Yards	Newcastle LEP	Local	404 Maitland Road, Hexham	Lot B, DP 405828	Located about 700 m from the project
Hannel Family Vault	Newcastle LEP	Local	398B Maitland Road, Hexham	Lot 1, DP 974950	Located about 700 m south of the project
Hexham Bridge	Newcastle LEP	Local	Pacific Highway	-	Located about 800 m from the project
Moreton Bay Fig trees	Port Stephens LEP	Local	2279 Pacific Highway, Heatherbrae	Road reserve near Lot 102, DP 807522	Located about 250 m from the project
Raymond Terrace Cemetery and Pioneer Hill	Port Stephens LEP	Local	1A and 2 Elizabeth Avenue and 4 Tod Street	Part Lot 20, DP 753161; Lots 7008 and 7009, DP 1051708	Located about 600 m from the project
Boomerang Park, including former stone quarry and mature tree planting	Port Stephens LEP	Local	17E Irrawang Street, Raymond Terrace	Lot 1, DP 1018979	Located about 800 m from the project

Reviews of previous heritage studies and a walkover of the study area were conducted as part of the route selection studies in 2006 (Maunsell AECOM, 2006). In addition to the listed items identified in **Table 5-1**, four unlisted items with potential heritage significance in the study area were identified, south of Heatherbrae. These include:

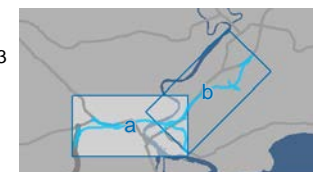
- Small old mine sites and quarries (located in the Motto Farm region)
- Motto Farm House
- A horse racing track (located within the grounds of Motto Farm)
- A family home, "Strength", built around 1931 at the horse racing track site (which is now demolished).

This 2006 study concluded that due to modification and development within the study area there was very limited likelihood of these items now remaining.

Undiscovered heritage relics may still be located in the area, although given that much of the study area consists of either disturbed road corridors, floodplain or water protection area, this potential is likely to be limited.

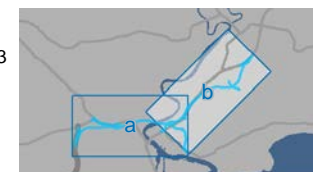
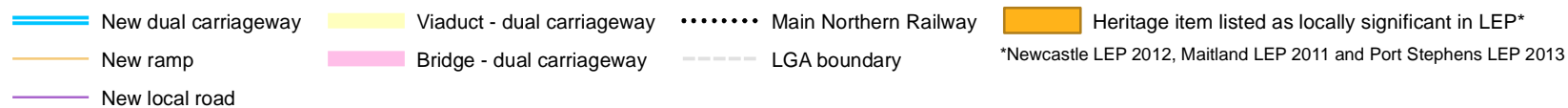


*Newcastle LEP 2012, Maitland LEP 2011 and Port Stephens LEP 2013



Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Jacobs 2015
 Department of Planning and Environment
 AUSIMAGE May 2014 and May 2015

Figure 5-2a Non-Aboriginal heritage items located within one kilometre of the project



Data sources
 Roads and Maritime Services 2015
 Land and Property Information 2014
 Jacobs 2015
 Department of Planning and
 Environment
 AUSIMAGE May 2014 and May 2015

Figure 5-2b Non-Aboriginal heritage items located within one kilometre of the project

5.4.2 Potential impacts

Construction

- There are no known heritage sites likely to be directly impacted by the project, although the area immediately south of Heatherbrae, associated with 'Motto Farm', may contain previously undiscovered heritage relics. There is potential for these sites to be disturbed and or damaged / destroyed during construction of the project
- The residence at 29 Eastern Avenue, Tarro is located in proximity of potential construction works, although direct impacts to this site are not anticipated. There would be, however, a potential for this residence to be indirectly impacted by construction vibration and potential changes to the visual character and viewpoints of this heritage item.

Operation

- Changes to the vistas to and from listed heritage items near the project.

5.4.3 Proposed further assessment

The non-Aboriginal heritage impacts of the project will be assessed in the EIS. The assessment will include:

- Historical research into the early settlement of the area and the potential for archaeological sites and unknown heritage items to be present in the study area
- An updated search of relevant databases for the study area
- A site walkover to identify any previously unlisted heritage items
- An assessment of the potential impacts of the project, for all identified heritage items
- Identification of reasonable and feasible safeguards and management measures to minimise any impact.

Assessment of the significance of heritage items that would be potentially impacted by the project would be carried out in accordance with the *Burra Charter* (Australian ICOMOS, 2013), *NSW Heritage Manual* (OEH, 2001) and the *Statement of Heritage Impact* (Heritage Office, 2002).

In the event that the project is predicted to impact on non-Aboriginal heritage, a Statement of Heritage Impact (SOHI) would be required. The SOHI would be conducted in accordance with the NSW Heritage Office guidelines for SOHI (NSW Heritage Office, 2002).

5.4.4 Safeguards and management measures

Non-Aboriginal heritage issues are commonly encountered on Roads and Maritime projects and can be managed and mitigated through the implementation of standard management and safeguard measures, which would be informed by the further assessment identified above and detailed in the EIS for the project. These would include:

- Managing the discovery of unknown heritage items or significant sites in accordance with the Standard Management Procedure: Unexpected Heritage Items (Roads and Maritime, 2015)
- Implementation of a heritage management plan that would identify responsibilities of construction personal to ensure heritage items are protected during the works.

5.5 Soils and contamination

5.5.1 Overview

A preliminary site investigation for contamination and acid sulfate soils (ASS) was prepared for the project in May 2015 (Douglas Partners, 2015). The investigation was carried out with reference to the *Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 2011), *National Environmental Protection (Assessment of Site Contamination) Amendment Measures 2013* (National Environmental Protection Council, 2013), and the *Acid Sulfate Soil Manual* (NSW Acid Sulfate Soil Management Advisory Committee, 1998). A summary of the investigation is provided below.

Soils

The Soil Landscapes of the Newcastle 1:100,000 Sheet identified the project to traverse a number of soil landscapes (Douglas Partners, 2015). These include:

- Beresfield residual landscape
- Hamilton residual landscape
- Millers Forest estuarine landscape
- Fullerton Cove estuarine landscape
- Hexham Swamp landscape
- Tea Gardens Landscape Variant Aeolian landscape
- Blind Harrys Swamp landscape
- Bobs Farm Beach Landscape.

Majority of the study area is underlain by unconsolidated Quaternary aged sediments, which are dominated by Holocene soft soils. These comprise upper soft soils and loose sands prone to potential acid sulphate soils (PASS) (Jacobs. 2015).

Acid sulfate soils

The central portion of the study area (between the Tomago Road and New England Highway interchanges) has been identified to have a high probability of ASS occurrence. In addition, a portion of the study area located near the Raymond Terrace interchange has also been identified to have a high probability of ASS occurrence. The eastern portion of the study area has been identified to have a low probability of ASS occurrence. The western portion of the study area (near the Black Hill interchange) has been identified to have no known occurrence of ASS.

Roads and Maritime has successfully managed acid sulphate soils and potential acid sulphate soils on other road construction projects and, while specialist management techniques may be required, these are typically well developed. The extent of acid sulphate soils identified to date is not anticipated to present a substantial constraint to the project's design progression or construction.

Salinity

The study area does not contain areas mapped on the salinity hazard map of NSW as being a moderate to very high salinity hazard (Douglas Partners, 2015). However, the study area contains several areas identified to contain dryland salinity characteristics. These include areas near Purgatory Creek (between Hexham Bridge and Tomago Road), within creek alignments in the western portion of the study area, and along Windeyers Creek in the eastern portion of the study area (Douglas Partners, 2015).

Contamination

A search of the NSW Environment Protection Authority's Register of Contaminated Land was carried out on 10 April 2015 (Douglas Partners, 2015). The search identified one site within or near the study area which has been issued a notice under the *Contaminated Land Management Act 1997* and/or Section 55 of the *Protection of the Environment Operations Act 1997*. Details of this site are provided in **Table 5-2**. The search identified three additional sites which have been issued with notices, however these were not considered further due to their distance from the project.

Table 5-2 NSW Environment Protection Authority Notices within or near the project

Declaration number	Address	Lot/DP	Name	Notice type	Notice date
274	1 Woodlands Close, Tarro	Lot 10 DP 582135	Green Acre Farm	Section 35 <i>Environmentally Hazardous Chemicals Act 1985</i> order	12/09/1991

A search of Environmental Protection Licences (EPLs), applications, notices, audits, pollution studies and reduction programs under the *Protection of the Environment Operations Act 1997* (POEO Act) was carried out on 10 April 2015 (Douglas Partners, 2015). The search identified numerous items at properties within the suburbs of Black Hill, Beresfield, Hexham, Heatherbrae, Tarro, Tomago and Raymond Terrace. Properties identified within the study area with licences under the POEO Act are listed in **Table 5-3**.

Table 5-3 Properties within the study area with POEO Licences

Suburb	Address	Name	Notice type	Notice date
Hexham	Aurizon Operations Ltd	Off Woodlands Close	POEO Licence	July 2014
Hexham	Brancourts Manufacturing & Processing Pty Ltd	189 Maitland Road	POEO Licence and s.58 Licence variation	May 2000 to March 2015
Hexham	Leighton Contractors Pty Ltd	Within and near the rail corridor from the Tarro interchange to rail track chainage 172.500	POEO Licence and s.80 Surrender of a Licence (pending)	December 2013 to March 2015
Tomago	11 Pacific Highway	RZM Pty Ltd	POEO Licence (surrendered)	January 2001
Raymond Terrace	Department of Primary Industries (herbicide)	Windeyers Creek Waterway	POEO Licence (surrendered)	February 2002

Suburb	Address	Name	Notice type	Notice date
	application)			
Raymond Terrace	Weathertex Pty Ltd	Masonite Road	POEO Licence (no longer in force) and s.58 Licence variation	August 2000 to April 2008

A number of potential Areas of Environmental Concern occur within the study area. These areas include contaminate sources that range from possible pesticide use at rural properties to indiscriminate dumping sites such that have occurred along service easements and access tracks.

5.5.2 Potential impacts

Construction

- Pollution of water courses from sediment laden surface water runoff
- Acid sulfate soils could be exposed to the air as a result of excavation and construction activity, resulting in the potential for sulphuric acid to impact groundwater, soils and waterways in addition to infrastructure
- Potential for construction activities to be located near existing contaminated sites (such as former petrol stations and other hazardous industries)
- Potential for construction activities to disturb contaminated material leading to the offsite migration of contaminants.

Operation

- Road transport activities leading to future contamination and waterway pollution (such as spillage) or a significant pollution event.

5.5.3 Proposed further assessment

Further assessment of potential impacts of the project on soils and contamination will be carried out during the preparation of the EIS. The assessment will:

- Review existing topography, soil (including acid sulphate and salinity risk maps), geological and contamination information pertaining to the project site and the findings of any soil testing that has occurred to inform potential impacts of the works
- Carry out geotechnical field investigations to further characterise the existing soil geotechnical conditions
- Identify sensitive surface and groundwater receiving environments (as per **section 4.3**)
- Search databases (including the Environmental Protection Authority (EPA) Public Register of Licenses, the OEH Contaminated Land Record of Notices and National Pollutant Inventory Database) to confirm potential contamination/pollution issues in the study area
- Confirm the findings of the Phase 1 environmental site assessment including a review of site history (including a review of historical aerial photographs and historical land title information)
- Assess the potential for subsidence and other associated land movements in the area, and the potential to encounter acid sulphate soil and/or saline soils or soft soils

- Review the soil types present to understand the potential sources and magnitude of erosion, including both water-borne and air-borne material. Assess erosion and sediment impacts during construction and operation. This task will include an assessment of existing water quality and the potential impacts of the project.

5.5.4 Safeguards and management measures

Potential soils and contamination impacts would be managed and mitigated through the implementation of standard safeguards and management measures. Standard safeguards and management measures would be developed in accordance with:

- Implementation of appropriate design practices to avoid impacting sites of known contamination, where possible
- Management of contaminated land in accordance with Roads and Maritime's Contaminated Land Management Guideline
- Soil and water quality impacts would be managed in accordance with the Blue Book – Managing Urban Stormwater, Soils and Construction Volume1 4th Edition, March 2014 (EPA, 2014 & DECC 2008)
- Stockpile sites would be managed in accordance with the Stockpile Site Management Guideline (EMS-TG-10) (RTA, 2011a)
- Construction dewatering carried out on site would be managed in accordance with the Technical Guideline Environmental Management of Construction Site Dewatering (EMS-TG-011) (RTA, 2011b)
- Where excavation is to be carried out in areas anticipated to contain acid sulfate soils, work would proceed according to an acid sulfate soils management plan, which would include specific controls to safeguard the environment. This would be in accordance with Roads and Maritime Contaminated Land Management Guideline (Roads and Maritime, 2011).

5.6 Air quality

5.6.1 Overview

The project is surrounded by industrial, commercial and agricultural land uses within the Newcastle and Port Stephens LGAs (refer to **section 5.2**). A search of the National Pollutant Inventory (NPI) found local air quality near the project to be influenced by a range of industry emissions and diffuse air emissions.

Industry emissions are generally caused from large-scale industrial activities, whereas diffuse air emissions are generally caused from non-industrial activities such as road car emissions, lawn mowing and other small-scale activities.

The most commonly reported industry emissions from the study area are total volatile organic compounds, particulate matter 10.0 micrometres and particulate matter 2.5 micrometres. The most commonly reported diffuse air emissions were xylenes (individual or mixed isomers), ethylbenzene, and total volatile organic compounds.

5.6.2 Potential impacts

Construction

- The generation of particulate and gaseous emissions from dust generating activities (such as excavation, vegetation clearing and wind erosion from unsealed surfaces and stockpiles) and the combustion of diesel and petrol fuel in construction plant, vehicles and equipment
- Reduced local air quality from dust emissions and the deposition of dust at nearby sensitive receivers
- Vehicles travelling on unsealed surfaces
- Vehicle emissions, such as exhaust fumes, during construction adversely affecting air quality.
- Operation
- The generation of exhaust emissions from vehicles using the M1 Pacific Motorway and surrounding road network
- Operational emissions exceed regulatory limits (eg carbon monoxide), with increased vehicle emissions in locations with existing low traffic volumes.

5.6.3 Proposed further assessment

Further assessment of potential air quality impacts will be carried out during the preparation of the EIS. The assessment will include:

- Identification of sensitive receivers (such as residential properties) located within the vicinity of the project
- An assessment of existing ambient air quality in the vicinity of the project
- An assessment of meteorological conditions which may influence the impacts of the project
- An assessment of the potential impacts of the project on air quality during construction and operation
- Identification of appropriate safeguards and management measures to reduce the impact of the project on air quality during construction and operation.

5.6.4 Safeguards and management measures

Air quality impacts would be minimised through the implementation of standard safeguards and management measures. An Air Quality Management Plan would be

prepared and included as part of the Environmental Management Plan (EMP). The plan would include:

- A map identifying locations of sensitive receivers (such as residential receivers) located within the vicinity of the project
- Identification of possible risks to air quality resulting from construction activities
- A process for monitoring the generation of dust on site, as well as weather conditions (such as wind)
- Measures to ensure the location of stockpile sites are as far as practicable from sensitive receivers (such as residential receivers)
- A process for the appropriate transportation of materials which may produce dust
- A method for suppressing dust on stockpile sites or unsealed areas
- Measures to maintain construction plant and equipment.

5.7 Greenhouse gas and climate change

5.7.1 Overview

Climate profiles for the Newcastle and Port Stephens LGAs are prepared within the *Hunter and Central Coast Regional Environment Management Strategy* (HCCREMS) (HCCREMS, 2009b).

Climate change projections from the HCCREMS relevant to the project include:

- Warmer average minimum temperatures during autumn and winter, with summer minimums expected to decrease along with a slight decrease during spring. Projected increases during autumn and winter are greater than the projected decreases for summer and spring, and thus an overall increase in annual average minimum temperatures is projected
- Maximum temperatures are projected to continue to increase in the Newcastle and Port Stephens LGAs during autumn and winter. Similar or slightly cooler average maximum temperatures are projected to occur during spring and summer
- Average annual rainfall patterns for the Newcastle and Port Stephens LGAs are projected to stay within the boundaries of existing known natural variability
- Increased frequency of extreme storms during autumn and winter
- Increased frequency of high rainfall events during summer and autumn. This is matched by a decrease during winter and spring to produce no overall annual change
- Increased frequency of extreme heat days during summer and autumn
- No change in winter frost events projected, however increases in autumn and spring are projected.

In addition, sea level on the NSW coast is expected to rise by 0.18 to 0.91 metres between 2090 and 2100 (Department of Environment and Climate Change, 2007).

5.7.2 Potential impacts

Construction

- Greenhouse gases would be emitted from loss of vegetation, vehicles, plant and construction equipment during construction of the project. These emissions would contribute to the total greenhouse gas emissions for NSW and would include:
 - Carbon dioxide, methane and nitrous oxide generated from liquid fuel (eg diesel and petrol) used in plant and vehicles
 - Embedded emissions associated with the manufacture and delivery of construction materials
 - Methane generated from depositing carbon-based waste to landfill.
- Climate change risks during construction of the project would primarily be associated with increased frequency and severity of extreme weather events (such as rainfall) and potential sea level rise. Increased frequency and severity of extreme weather events may result in increased pressure on erosion and sediment control measures and increased stormwater runoff and flood extents within the study area.

Operation

- Greenhouse gases emitted during the operation of the project would be associated with maintenance activities and the operation of private motor vehicles on the road network. These emissions would contribute to the total greenhouse gas emissions for NSW
- Climate change risks during operation of the project would primarily be associated with increased frequency and severity of extreme weather events (such as rainfall). Increased frequency and severity of extreme weather events may result in increased pressure on drainage infrastructure and flooding of the study area.

5.7.3 *Proposed further assessment*

Further assessment of potential greenhouse gas and climate change impacts will be carried out during the preparation of the EIS. The assessment will include:

- A description of the existing climatic environment of the project including projected climatic change predictions for the Hunter Region
- Identification and assessment of potential impacts of the project on greenhouse gas, climate change and sea level rise during construction and operation
- Identification of safeguards and management measures to reduce the impact of the project on greenhouse gas and climate change.

The impact of the project on greenhouse gas emissions and climate change would also be considered during the development of the concept design.

5.7.4 *Safeguards and management measures*

Greenhouse gas and climate change impacts would be managed and mitigated through the implementation of standard safeguards and management measures. These would include:

- Considering energy efficiency and carbon emissions when selecting vehicles, plant and construction equipment
- Using appropriately sized vehicles, plant and construction equipment for the task and properly maintaining such equipment to achieve optimum fuel efficiency
- Switching off vehicles, plant and construction equipment when not in use
- Sourcing materials from local suppliers to reduce transport emissions
- Reducing vegetation clearing as much as practicable, and re-establishing vegetation in suitable areas following construction
- Reducing waste and recycling waste as a preference before disposing to landfill
- The Environmental Management Plan would include environmental safeguards and management measures to accommodate and response to the increased frequency and severity of rainfall events.

5.8 Waste and resource management

5.8.1 Overview

The existing road network generates minimal waste. Waste sources are generally limited to roadside litter, some waste material from cleaning roadside drainage, and green waste associated with the maintenance of roadside vegetation and possible agricultural activities.

5.8.2 Potential impacts

Construction

- The generation of general waste from construction sites (such as litter, office waste, and scrap material)
- The depletion or sterilisation of non-renewable natural resources (such as virgin quarried materials and sand required during construction)
- The generation of packaging materials (such as crate, pallets, cartons, plastics and wrapping materials)
- Spills and leaks from vehicles and construction machinery
- The disposal of unsuitable or surplus earthworks material
- The disposal of hazardous materials.

Operation

- Increased electricity consumption
- Generation of waste from construction activities.

5.8.3 Proposed further assessment

Further assessment of potential impacts of the project on waste and resource management would be carried out during the preparation of the EIS. The assessment would include:

- Identification of the indicative resource requirements for the project and an assessment of the resource use impacts of the project
- Identification of specific waste impacts of the project, as well as opportunities to reduce waste (such as the use of recycled materials, bulk delivery of good to minimise packaging and arrangements with suppliers to return any unused construction materials)
- Identification of opportunities to use recycled materials (provided they are fit for purpose and meet engineering requirements)
- Implementation of strategies to minimise the volume of excavated material disposal to landfill

5.8.4 Safeguards and management measures

Waste and resource management issues would be managed and mitigated through the implementation of standard safeguards and management measures. These would include:

- Unnecessary resource use would be avoided. Where avoidance is not possible, waste would be processed for resource recovery (including reuse of materials, reprocessing, recycling and energy recovery)
- Where resource recovery is not possible, waste would be disposed as a last resort at an appropriately licensed waste facility – in accordance with the Waste

Avoidance and Resource Recovery Act 2001 and the EPA waste classification guidelines

- Procurement would endeavour to use materials and products with a recycled content, provided that material or product is cost-effective and performance-effective
- A Resource and Waste Management Plan would be prepared and would include: The type, classification and volume of all materials to be generated and used on site including identification of recyclable and non-recyclable waste in accordance with the Waste Classification Guidelines (NSW EPA, 2014)
- Quantity and classification of excavated material generated as a result of the project (refer to Roads and Maritime's Waste Management Fact sheets 1-6, 2012)
- Procedures for site clean-up following the completion of each construction stage.

5.9 Hazards and risks

5.9.1 Overview

Several hazards and risks have been identified near the project, including utilities, bushfire prone land, flood prone land (refer to **section 4.2**), the Tomago Sandbeds Catchment, potential areas of contamination (refer to **section 4.3**), and sensitive ecological areas (refer to **section 4.4**).

In addition, preliminary environmental investigations also noted the operation of the existing road network (including current crash rates) near the project to be a hazard and risk.

5.9.2 Potential impacts

Construction

- Accidental spills of hazardous chemicals (including fuels and chemicals) during the operation of construction plant and equipment
- Impacts to human health from accidental spills or improper handling of dangerous goods and hazardous materials
- The unexpected find of contaminated material or utility infrastructure during excavation
- Increased risk of bushfire to areas immediately near the project from the operation of construction plant and equipment
- Potential risk of increased crash rates near the project due to changed traffic conditions within the existing road network
- Potential risk of a major flood event causing damage to construction plant and equipment or posing a hazard to human life.

Operation

The project is not anticipated to result in any additional hazards and risks during operation.

5.9.3 Proposed further assessment

Further assessment of potential impacts of the project on hazards and risks would be carried out during the preparation of the EIS. The assessment would include a desktop analysis of existing hazards and risks within the project site, potential hazards and risks which may arise during the construction and operation of the project, and detailed safeguards and management measures.

5.9.4 Safeguards and management measures

Potential hazards and risks would be managed and mitigated through the implementation of standard safeguards and management measures. These would include:

- Any hazardous chemicals would be stored in a securely bunded area during construction
- An appropriate spill kit would be available at all times, and any accidental spills with hazardous or contaminated material would be cleaned up immediately and reported as required
- Major plant and machinery would be re-fuelled either off-site or by a mobile mini fuel tanker with a spill procedure and spill kit
- The transport of dangerous goods or hazardous materials would be carried out by an appropriately licensed contractor

- Site-specific plans would be prepared and implemented for the project, including an incident management plan which would identify potential incidents which may occur during construction and the corresponding incident response procedures.

6 Conclusion

Roads and Maritime is seeking approval for the extension of M1 Pacific Motorway from Black Hill to the A1 Pacific Highway at Raymond Terrace.

The M1 Pacific Motorway extension to Raymond Terrace would comprise about 15 kilometres of four lane divided road.

The project is declared to be critical State significant infrastructure under section 115V of the *Environmental Planning and Assessment Act 1979* (EP&A Act), as it is considered to be essential to the State for economic, environmental or social reasons.

In accordance with clause 16 of State Environmental Planning Policy (State and Regional Development) 2011, the project is also State significant infrastructure under section 115U of the EP&A Act and is permissible without consent under Part 4 of the EP&A Act. The project is, therefore, State significant infrastructure under Part 5.1 of the EP&A Act. The project requires the preparation of an environmental impact statement (EIS) and requires the approval from the Minister for Planning.

The key environmental issues identified for the project include:

- Hydrology and flooding, such as the potential for increased flood levels and changes to drainage patterns
- Ground and surface water, such as potential impacts on groundwater dependent ecosystems, and water quality within the Tomago Sandbeds Catchment Area (drinking water aquifer)
- Biodiversity, such as potential impacts to areas of habitat value for Koala (*Phascolarctos cinereus*), clearing of threatened ecological communities, and impacts to SEPP 14 wetlands, key fish habitat, and other aquatic and riparian habitats
- Aboriginal cultural heritage, such as direct and indirect impacts to registered Aboriginal sites or PADs
- Traffic and transport, such as the potential for reduced performance of the surrounding road network due temporary land/road closures, permanent adjustment to some private property access roads and local and regional roads, as well as reduced congestion and improved travel times on the local and regional road network
- Noise and vibration, such as the potential for noise exceedances at sensitive receiver locations
- Landscape character and visual amenity, such as the introduction of major visual features into sensitive landscapes.

The EIS would include:

- A detailed description of the project including its components, construction activities and potential staging of delivery
- A comprehensive assessment of the potential impacts on the key issues including a description of the existing environment, assessment of potential direct and indirect and construction, operation and staging impacts
- Description of measures to be implemented to avoid, minimise, manage, mitigate, offset and/or monitor the potential impacts
- Identify and address issues raised by stakeholders.

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8 Abbreviations and Glossary

Acronym	Definition
A1 Pacific Highway	A major transport route connecting Sydney and Brisbane. The section of Pacific Highway of relevance to the project is the section between Hexham and Raymond Terrace.
AADT	Annual average daily traffic, the total volume of traffic passing a roadside observation point over a period of a year, divided by the number of days per year.
AEP	Annual exceedance probability
Afflux	Increase in flood water depth caused by a constraint on the floodplain such as a road embankment and a viaduct.
Alignment	The geometric layout (eg of a road) in plan (horizontal) and elevation (vertical).
ARTC	Australian Rail Track Corporation
Arterial roads	The main or trunk roads of the State road network.
Aquifer	An underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, or silt) from which groundwater can be usefully extracted.
Aquifer Interference Policy	The policy that sets out the requirements for assessing the impacts that aquifer interference activities have on water resources.
Bore	A drilled hole constructed by a drilling rig to access groundwater.
Catchment	Land area collecting rainfall and contributing to surface water or groundwater.
CEMP	Construction Environment Management Plan
CLG	Community liaison group
Concept design	Initial functional layout of a road/road system or other infrastructure.
Constraint	Something that limits or restricts the project design, development or construction.
Constructability	Refers to the ease in which a project can be built.
DECCW	Department of Environment, Climate Change and Water
DIRD	Department of Infrastructure and Regional Development
Environmental assessment (process)	A specialised part of the decision-making process, where the environmental impact of a development or proposal or activity is considered in detail, together with other aspects of the development.
EIS	Environmental Impact Statement

Acronym	Definition
Embankment	An embankment is a mound of earth which can be built to support road infrastructure.
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
Floodplain	An area of low-lying ground next to a river, often prone to flooding.
Functionality	A term that describes the effectiveness of an element of the project.
GMA	Groundwater management area. GMAs are areas which have defined management boundaries and have been intensively developed.
Groundwater dependent ecosystems	Communities of plants, animals and other organisms within an area that depend on underground water for their water needs.
Habitat	The place where a species, population or ecological community lives (whether permanently, periodically or occasionally). Habitats are measurable and can be described by their flora and physical components.
HRBG	Hunter Region Botanic Gardens
Hunter drinking catchment	Water water The area within the Lower Hunter that collects drinking water.
Interchange	A grade separated junction between roads where the local road passes above or beneath the highway via bridge or underpass structure with one or more interconnecting roadways.
Key fish habitat	Aquatic habitats that are important to the sustainability of the recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species. Further definition is provided in the <i>Fisheries Management Act 1994</i> .
km/h	Kilometres per hour
kV	Kilovolts
LEP	Local Environment Plan (in the meaning of the EP&A Act).
LEP corridor	An area gazetted in the Newcastle City and Port Stephens Councils' LEPs for the project.
LGA	Local Government Area
M1 Pacific Motorway	A major road linking Sydney to the Central Coast, Newcastle and the Hunter Regions.
MCA	Multi-criteria analysis

Acronym	Definition
Migratory species	Species listed as migratory under the EPBC Act relating to international agreements to which Australia is a signatory. These include Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA), Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) and the Bonn Convention on the Conservation of Migratory Species of Wild Animals.
NSW	New South Wales
OEH	Office of Environment and Heritage
Pacific Highway upgrade program	Program to upgrade the Pacific Highway within NSW to provide a four lane divided road from Hexham to Queensland.
Paleo-channel	A historical river channel filled with soft sediments.
Property acquisition	In the context of the project, property acquisition refers to purchasing property from owners to provide land for the project.
Raymond Terrace Bypass	The A1 Pacific Highway located to the east of Raymond Terrace. This section of road is a dual carriageway, four lane road of Motorway standard.
Riparian habitat	Riparian refers to the area between land and a waterway. This area often provides habitat for animal and plant species.
Roads and Maritime	Roads and Maritime Services
Runoff	Water which does not infiltrate into the soil, and flows downslope over the ground surface.
SEPP	State Environmental Planning Policy (in the meaning of the EP&A Act).
SEPP 14	State Environmental Planning Policy 14 – Coastal Wetlands
SEPP 44	State Environmental Planning Policy No 44 – Koala Habitat Protection
Sight distance	The distance that motorists need to see ahead to drive safely.
Stakeholder	Organisations, parties and/or special interest groups likely to have an interest in the proposal.
State Significant Infrastructure	Refers to major infrastructure, in particular linear infrastructure such as roads, railway lines or pipes which often cross a number of council boundaries, or where development may have a significant environmental impact (in the meaning of the EP&A Act).
State Significant Infrastructure Application	An application to the NSW Department of Planning and Environment to demonstrate that a project meets the criteria for state significant infrastructure (as outlined in the State Environmental Planning Policy (State and Regional Development 2011)), and to request Secretary's environmental assessment requirements (SEAR). The application is also accompanied by a report that details the proposal and its likely environmental impacts.
Study area	The study area encompasses the proposal area and the area that may be indirectly impacted by the proposal.

Acronym	Definition
TEC	Threatened Ecological Communities. For the purposes of this report this includes ecological communities listed or nominated under the EPBC Act and ecological communities listed or nominated under the TSC Act.
Threatened	As defined under the NSW <i>Threatened Species Conservation Act 1995</i> . A species, population or ecological community that is likely to become extinct or is in immediate danger of extinction.
Tributary	A river or stream that flows into a larger river or lake.
TSC Act	<i>Threatened Species Conservation Act 1995</i>
Viaducts	A viaduct is a bridge-like structure which can be used to provide for road infrastructure across low ground.
Water Sharing Plan	Outlines the rules for how water is allocated within certain areas. The purpose of a water sharing plan is to protect the fundamental environmental health of the water source, ensure the water source is sustainable in the long term and provide water users with a clear indication of when and how water will be available for extraction. Water sharing plans are being developed following the introduction of the <i>Water Management Act 2000</i> .
Weaving	The undesirable situation where traffic merging and diverging must cross paths within a limited distance, usually before an intersection.
Wetland	A swamp or marsh in which the soil is frequently or permanently saturated with water, or under water.
Wick drainage	Artificial vertical drains that allow soft soils to consolidate.
Wildlife corridors	Wildlife corridors are strips of native vegetation that join two or more areas of similar habitat, and are critical for sustaining ecological processes, such as provision for animal movement and the maintenance of genetically viable populations.

Appendix A - Requirements of the Environmental Planning and Assessment Regulation 2000

Clause 192 of the Environmental Planning and Assessment Regulation 2000 requires that an application for approval of the Minister to carry out State significant infrastructure must include:

- (a) details of any approval that would, but for section 115ZG of the Act, be required for the carrying out of the State significant infrastructure, and
- (b) details of any authorisations that must be given under section 115ZH of the Act if the application is approved, and
- (c) a statement as to the basis on which the proposed infrastructure is State significant infrastructure, including, if relevant, the capital investment value of the proposed infrastructure.

Approvals that would otherwise apply

Approvals that may be required to carry out the SSI, if not for section 115ZG of the *EP&A Act*, include:

- Permit under section 201 of the *Fisheries Management Act 1994* for dredging or reclamation work
- Permit under section 205 of the *Fisheries Management Act 1994* for harm to saltmarsh or mangroves
- Permit under section 219 of the *Fisheries Management Act 1994* for temporary obstruction to fish passage
- Application under Part 4 of the *EP&A Act* for impact on SEPP 14 coastal wetlands
- Permit under section 90 of the *National Parks and Wildlife Act 1974* for impact on PADs
- An authorisation referred to in section 12 of the *Native Vegetation Act 2003* (or under any Act repealed by that Act) to clear native vegetation or State protected land
- Permit for excavation under section 139 of the *Heritage Act 1977*
- A water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000*.

Authorisations if the application is approved

Authorisations that may be required for the project under section 115ZH of the *EP&A Act* include:

- An environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in section 43 of that Act)
- A consent under section 138 of the *Roads Act 1993*.

State significant infrastructure statement

Clause 14(1) of *State Environmental Planning Policy (State and Regional Development) 2011* provides that development is declared to be State significant infrastructure pursuant to section 115U(2) of the Act if it is permissible without development consent under Part 4 of the Act under a State environmental planning policy; and is specified in the categories of development in Schedule 3.

State Environmental Planning Policy (Infrastructure) (ISEPP) permits development 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 M1 Pacific Motorway Extension to Raymond Terrace is for a road and road infrastructure facilities, and is to be carried out by Roads and Maritime, the project is permissible without development consent under Part 4 of the EP&A Act.

The project is declared to be critical State significant infrastructure under section 115V of the *Environmental Planning and Assessment Act 1979* (EP&A Act), as it is considered to be essential to the State for economic, environmental or social reasons.

In accordance with clause 16 of *State Environmental Planning Policy (State and Regional Development) 2011*, the project is also State significant infrastructure under section 115U of the EP&A Act and is permissible without consent under Part 4 of the EP&A Act. The project is, therefore, State significant infrastructure under Part 5.1 of the EP&A Act. The project requires the preparation of an environmental impact statement (EIS) and requires the approval from the Minister for Planning.

On this basis the project is State significant infrastructure. Approval from the Minister for Planning is required under section 115W of the EP&A Act.

Appendix B - Biodiversity database search results



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

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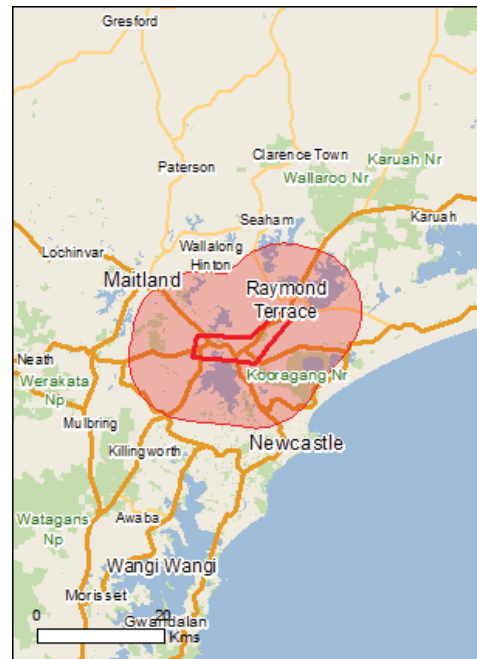
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Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	58
Listed Migratory Species:	61

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage/index.html>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	12
Commonwealth Heritage Places:	1
Listed Marine Species:	62
Whales and Other Cetaceans:	1
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	7
Regional Forest Agreements:	1
Invasive Species:	47
Nationally Important Wetlands:	3
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)		[Resource Information]
Name		Proximity
Hunter estuary wetlands		Within Ramsar site

Listed Threatened Ecological Communities	[Resource Information]
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For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community may occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

Listed Threatened Species	[Resource Information]
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Name	Status	Type of Presence
Birds		
Anthochaera phrygia		
Regent Honeyeater [82338]	Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus		
Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora epomophora		
Southern Royal Albatross [25996]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora sanfordi		
Northern Royal Albatross [82331]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans antipodensis		
Antipodean Albatross [82269]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans exulans		
Tristan Albatross [82337]	Endangered	Species or species habitat may occur within area
Diomedea exulans gibsoni		
Gibson's Albatross [82271]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato)		
Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
to occur within area		
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta salvini Salvin's Albatross [82343]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Fish		
Epinephelus daemeli Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
Litoria littlejohni Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Acacia bynoeana		
Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat likely to occur within area
Allocasuarina defungens		
Dwarf Heath Casuarina [21924]	Endangered	Species or species habitat likely to occur within area
Angophora inopina		
Charmhaven Apple [64832]	Vulnerable	Species or species habitat likely to occur within area
Asperula asthenes		
Trailing Woodruff [14004]	Vulnerable	Species or species habitat likely to occur within area
Asterolasia elegans		
[56780]	Endangered	Species or species habitat likely to occur within area
Commersonia prostrata		
Dwarf Kerrawang [87152]	Endangered	Species or species habitat likely to occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Diuris praecox		
Newcastle Doubletail [55086]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus camfieldii		
Camfield's Stringybark [15460]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus parramattensis subsp. decadens		
Earp's Gum, Earp's Dirty Gum [56148]	Vulnerable	Species or species habitat known to occur within area
Euphrasia arguta		
[4325]	Critically Endangered	Species or species habitat may occur within area
Grevillea parviflora subsp. parviflora		
Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area
Melaleuca biconvexa		
Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Pelargonium sp. Striatellum (G.W.Carr 10345)		
Omeo Stork's-bill [84065]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Persicaria elatior Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area
Rutidosia heterogama Heath Wrinklewort [13132]	Vulnerable	Species or species habitat likely to occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Pocket-less Brush Cherry, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat likely to occur within area
Tetratheca juncea Black-eyed Susan [21407]	Vulnerable	Species or species habitat known to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area

Reptiles

Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species

[[Resource Information](#)]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within

Name	Threatened	Type of Presence area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered*	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Roosting known to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Breeding likely to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Roosting known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Roosting known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]		Roosting known to occur

Name	Threatened	Type of Presence
Charadrius bicinctus Double-banded Plover [895]		within area Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]		Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Roosting known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew [847]		Roosting known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion cristatus Eastern Osprey [82411]		Species or species habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Postal Corporation
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Commonwealth Trading Bank of Australia
Commonwealth Land - Defence Housing Authority
Commonwealth Land - Defence Service Homes Corporation
Commonwealth Land - Director of Defence Service Homes
Commonwealth Land - Director of War Service Homes
Commonwealth Land - Telstra Corporation Limited
Defence - RAAF BASE WILLIAMTOWN
Defence - STOCKTON RIFLE RANGE

Commonwealth Heritage Places [\[Resource Information \]](#)

Name	State	Status
Historic		
Williamtown RAAF Base Group	NSW	Listed place

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Roosting known to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis		
Cattle Egret [59542]		Breeding likely to occur within area
Arenaria interpres		
Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus		
Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]		Roosting known to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Roosting known to occur within area
Calidris ruficollis		
Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris		
Great Knot [862]		Roosting known to occur within area
Charadrius bicinctus		
Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]		Roosting known to occur within area

Name	Threatened	Type of Presence
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
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Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Roosting known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Roosting known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within

Name	Threatened	Type of Presence area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew [847]		Roosting known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable*	Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	to occur within area Foraging, feeding or related behaviour likely to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Reptiles

Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves		[Resource Information]
Name	State	
Blue Gum Hills	NSW	
Hexham Swamp	NSW	
Hunter Wetlands	NSW	
Medowie	NSW	
Pambalong	NSW	
Tilligerry	NSW	
Worimi	NSW	

Regional Forest Agreements		[Resource Information]
Note that all areas with completed RFAs have been included.		
Name	State	
North East NSW RFA	New South Wales	

Invasive Species		[Resource Information]
Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.		

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species

Name	Status	Type of Presence
Lantana camara		habitat may occur within area
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp.		
Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata		
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus		
Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus		
Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate		
Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla		
Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii		
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta		
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis		
Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Solanum elaeagnifolium		
Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area

Nationally Important Wetlands		[Resource Information]
Name		State
Hexham Swamp		NSW
Kooragang Nature Reserve		NSW
Shortland Wetlands Centre		NSW

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.799472 151.629469,-32.801203 151.704485,-32.765412 151.75358,-32.769165 151.771948,-32.813323 151.729204,-32.833086 151.71324,-32.829335 151.678049,-32.824431 151.623976,-32.799183 151.629812

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [Department of Environment, Climate Change and Water, New South Wales](#)
- [Department of Sustainability and Environment, Victoria](#)
- [Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [Department of Environment and Natural Resources, South Australia](#)
- [Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts](#)
- [Environmental and Resource Management, Queensland](#)
- [Department of Environment and Conservation, Western Australia](#)
- [Department of the Environment, Climate Change, Energy and Water](#)
- [Birds Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [Museum Victoria](#)
- [Australian Museum](#)
- [SA Museum](#)
- [Queensland Museum](#)
- [Online Zoological Collections of Australian Museums](#)
- [Queensland Herbarium](#)
- [National Herbarium of NSW](#)
- [Royal Botanic Gardens and National Herbarium of Victoria](#)
- [Tasmanian Herbarium](#)
- [State Herbarium of South Australia](#)
- [Northern Territory Herbarium](#)
- [Western Australian Herbarium](#)
- [Australian National Herbarium, Atherton and Canberra](#)
- [University of New England](#)
- [Ocean Biogeographic Information System](#)
- [Australian Government, Department of Defence](#)
- [State Forests of NSW](#)
- [Geoscience Australia](#)
- [CSIRO](#)
- Other groups and individuals































The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.
























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Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1Å°; ^^ rounded to 0.01Å°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Public Report of all Valid Records of Threatened (listed on TSC Act 1995) ,Commonwealth listed ,CAMBA listed ,JAMBA listed or ROKAMBA listed Entities in selected area [North: -32.74 West: 151.59 East: 151.79 South: -32.85] returned a total of 2,327 records of 70 species.

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Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Animalia	Amphibia	Myobatrachidae	3137	<i>Crinia tinnula</i>		Wallum Froglet	V,P		4	
Animalia	Amphibia	Hylidae	3166	<i>Litoria aurea</i>		Green and Golden Bell Frog	E1,P	V	10	
Animalia	Aves	Anseranatidae	0199	<i>Anseranas semipalmata</i>		Maggie Goose	V,P		5	
Animalia	Aves	Anatidae	0214	<i>Stictonetta naevosa</i>		Freckled Duck	V,P		1	
Animalia	Aves	Columbidae	0025	<i>Ptilinopus magnificus</i>		Wompoo Fruit-Dove	V,P		1	
Animalia	Aves	Columbidae	0023	<i>Ptilinopus superbus</i>		Superb Fruit-Dove	V,P		1	
Animalia	Aves	Apodidae	0334	<i>Hirundapus caudacutus</i>		White-throated Needletail	P	C,J,K	2	
Animalia	Aves	Procellariidae	0069	<i>Ardenna pacificus</i>		Wedge-tailed Shearwater	P	J	1	
Animalia	Aves	Ciconiidae	0183	<i>Ephippiorhynchus asiaticus</i>		Black-necked Stork	E1,P		61	
Animalia	Aves	Ardeidae	0977	<i>Ardea ibis</i>		Cattle Egret	P	C,J	56	
Animalia	Aves	Ardeidae	0197	<i>Botaurus poiciloptilus</i>		Australasian Bittern	E1,P	E	3	
Animalia	Aves	Ardeidae	0196	<i>Ixobrychus flavicollis</i>		Black Bittern	V,P		1	
Animalia	Aves	Threskiornithidae	0178	<i>Plegadis falcinellus</i>		Glossy Ibis	P	C	10	
Animalia	Aves	Accipitridae	0218	<i>Circus assimilis</i>		Spotted Harrier	V,P		2	
Animalia	Aves	Accipitridae	0226	<i>Haliaeetus leucogaster</i>		White-bellied Sea-Eagle	P	C	76	
Animalia	Aves	Accipitridae	0231	^^ <i>Hamirostra melanosternon</i>		Black-breasted Buzzard	V,P,3		1	
Animalia	Aves	Accipitridae	0225	<i>Hieraaetus morphnoides</i>		Little Eagle	V,P		2	
Animalia	Aves	Accipitridae	0230	^^ <i>Lophoictinia isura</i>		Square-tailed Kite	V,P,3		2	
Animalia	Aves	Accipitridae	8739	^^ <i>Pandion cristatus</i>		Eastern Osprey	V,P,3		10	
Animalia	Aves	Charadriidae	8006	<i>Pluvialis fulva</i>		Pacific Golden Plover	P	C,J,K	9	
Animalia	Aves	Rostratulidae	0170	<i>Rostratula australis</i>		Australian Painted Snipe	E1,P	E	3	
Animalia	Aves	Scolopacidae	0157	<i>Actitis hypoleucos</i>		Common Sandpiper	P	C,J,K	1	
Animalia	Aves	Scolopacidae	0163	<i>Calidris acuminata</i>		Sharp-tailed Sandpiper	P	C,J,K	16	
Animalia	Aves	Scolopacidae	0162	<i>Calidris ruficollis</i>		Red-necked Stint	P	C,J,K	7	
Animalia	Aves	Scolopacidae	0168	<i>Gallinago hardwickii</i>		Latham's Snipe	P	C,J,K	26	
Animalia	Aves	Scolopacidae	0149	<i>Numenius madagascariensis</i>		Eastern Curlew	P	CE,C,J,K	11	
Animalia	Aves	Scolopacidae	0150	<i>Numenius phaeopus</i>		Whimbrel	P	C,J,K	4	
Animalia	Aves	Scolopacidae	0158	<i>Tringa nebularia</i>		Common Greenshank	P	C,J,K	9	
Animalia	Aves	Scolopacidae	0159	<i>Tringa stagnatilis</i>		Marsh Sandpiper	P	C,J,K	4	
Animalia	Aves	Laridae	0112	<i>Hydroprogne caspia</i>		Caspian Tern	P	C,J	2	
Animalia	Aves	Cacatuidae	0268	^^ <i>Callocephalon fimbriatum</i>		Gang-gang Cockatoo	V,P,3		2	
Animalia	Aves	Cacatuidae	0265	^ <i>Calyptorhynchus lathamii</i>		Glossy Black-Cockatoo	V,P,2		3	
Animalia	Aves	Psittacidae	0260	<i>Glossopsitta pusilla</i>		Little Lorikeet	V,P		17	
Animalia	Aves	Psittacidae	0309	^^ <i>Lathamus discolor</i>		Swift Parrot	E1,P,3	E	2	
Animalia	Aves	Psittacidae	0302	^^ <i>Neophema pulchella</i>		Turquoise Parrot	V,P,3		3	
Animalia	Aves	Strigidae	0246	^^ <i>Ninox connivens</i>		Barking Owl	V,P,3		1	
Animalia	Aves	Strigidae	0248	^^ <i>Ninox strenua</i>		Powerful Owl	V,P,3		11	
Animalia	Aves	Tytonidae	0252	^^ <i>Tyto longimembris</i>		Eastern Grass Owl	V,P,3		21	
Animalia	Aves	Tytonidae	0250	^^ <i>Tyto novaehollandiae</i>		Masked Owl	V,P,3		9	
Animalia	Aves	Tytonidae	9924	^^ <i>Tyto tenebricosa</i>		Sooty Owl	V,P,3		1	
Animalia	Aves	Meropidae	0329	<i>Merops ornatus</i>		Rainbow Bee-eater	P	J	2	
Animalia	Aves	Meliphagidae	0448	<i>Epthianura albifrons</i>		White-fronted Chat	V,P		9	
Animalia	Aves	Meliphagidae	8303	<i>Melithreptus gularis gularis</i>		Black-chinned Honeyeater (eastern subspecies)	V,P		3	
Animalia	Aves	Pomatostomidae	8388	<i>Pomatostomus temporalis temporalis</i>		Grey-crowned Babbler (eastern subspecies)	V,P		17	
Animalia	Aves	Neosittidae	0549	<i>Daphoenositta chrysoptera</i>		Varied Sittella	V,P		8	
Animalia	Aves	Petroicidae	0380	<i>Petroica boodang</i>		Scarlet Robin	V,P		2	
Animalia	Mammalia	Dasyuridae	1008	<i>Dasyurus maculatus</i>		Spotted-tailed Quoll	V,P	E	2	

Animalia	Mammalia	Dasyuridae	1017	<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V,P		2	
Animalia	Mammalia	Phascolarctidae	1162	<i>Phascolarctos cinereus</i>	Koala	V,P	V	1184	
Animalia	Mammalia	Petauridae	1137	<i>Petaurus norfolcensis</i>	Squirrel Glider	V,P		31	
Animalia	Mammalia	Pteropodidae	1280	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V,P	V	49	
Animalia	Mammalia	Emballonuridae	1321	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	V,P		7	
Animalia	Mammalia	Molossidae	1329	<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V,P		75	
Animalia	Mammalia	Vespertilionidae	1372	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V,P		38	
Animalia	Mammalia	Vespertilionidae	1346	<i>Miniopterus australis</i>	Little Bentwing-bat	V,P		113	
Animalia	Mammalia	Vespertilionidae	1834	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V,P		52	
Animalia	Mammalia	Vespertilionidae	1357	<i>Myotis macropus</i>	Southern Myotis	V,P		37	
Animalia	Mammalia	Vespertilionidae	1361	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V,P		40	
Animalia	Mammalia	Vespertilionidae	1025	<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V,P		21	
Animalia	Mammalia	Muridae	1455	<i>Pseudomys novaehollandiae</i>	New Holland Mouse	P	V	16	
Plantae	Flora	Apocynaceae	1226	<i>Cynanchum elegans</i>	White-flowered Wax Plant	E1,P	E	1	
Plantae	Flora	Elaeocarpaceae	6206	<i>Tetradlea juncea</i>	Black-eyed Susan	V,P	V	11	
Plantae	Flora	Juncaginaceae	3363	<i>Maundia triglochinoides</i>		V,P		3	
Plantae	Flora	Malvaceae	14618	<i>Commersonia prostrata</i>	Dwarf Kerrawang	E1,P	E	1	
Plantae	Flora	Myrtaceae	4007	<i>Callistemon linearifolius</i>	Netted Bottle Brush	V,P,3		10	
Plantae	Flora	Myrtaceae	9163	<i>Eucalyptus parramattensis subsp. decadens</i>		V,P	V	176	
Plantae	Flora	Polygonaceae	5280	<i>Persicaria elatior</i>	Tall Knotweed	V,P	V	1	
Plantae	Flora	Proteaceae	10009	<i>Grevillea parviflora subsp. parviflora</i>	Small-flower Grevillea	V,P	V	2	
Plantae	Flora	Scrophulariaceae	5954	<i>Euphrasia arguta</i>		E4A,P	CE	1	
Plantae	Flora	Zannichelliaceae	6339	<i>Zannichellia palustris</i>		E1,P		2	



<http://www.rms.nsw.gov.au/projects/hunter/m1-motorway-raymond-terrace-upgrade/>



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