Pacific Highway
Lisarow to Ourimbah
Review of environmental factors
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Roads and Traffic Authority (RTA)

HW10 Pacific Highway Lisarow to F3 Stage 3A (Lisarow to Ourimbah) Upgrade

Review of Environmental Factors

Stage 3A: Ourimbah Street, Lisarow to Glen Road, Ourimbah

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CONTENTS

Glossary and Abbreviations.................................................................................. vi
Executive summary ........................................................................................ 1
1 Introduction........................................................................................................ 5
  1.1 Background ............................................................................................. 5
  1.2 Proposal identification ........................................................................... 5
  1.3 Purpose of this REF ............................................................................... 7
2 Need and options considered ......................................................................... 8
  2.1 Strategic need for the proposal.............................................................. 8
  2.2 Proposal objectives ................................................................................ 9
  2.3 Methodology for selection of preferred option........................................ 9
  2.4 Options considered.............................................................................. 11
  2.5 Summary of Preferred Option ............................................................... 16
3 Description of the proposal .......................................................................... 17
  3.1 Existing road and infrastructure ............................................................ 18
  3.2 Design features ..................................................................................... 21
  3.3 Public utilities ....................................................................................... 34
  3.4 Property acquisition and adjustment ................................................... 34
  3.5 Construction activities ......................................................................... 35
  3.6 Ancillary features.................................................................................. 41
4 Statutory and planning framework ................................................................ 42
  4.1 State Environmental Planning Policies (SEPPs).................................... 42
  4.2 Local Environmental Plans (LEPs) ....................................................... 42
  4.3 Other relevant legislation ...................................................................... 45
  4.4 Confirmation of statutory position ....................................................... 48
5 Stakeholder and community consultation .................................................... 49
  5.1 Consultation strategy............................................................................. 49
  5.2 Community involvement ...................................................................... 49
  5.3 Community feedback ........................................................................... 51
  5.4 Aboriginal community involvement ..................................................... 52
  5.5 Government agency and stakeholder involvement............................... 53
  5.6 Ongoing and future consultation ......................................................... 57
6 Environmental assessment .......................................................................... 58
  6.1 Ecology ................................................................................................. 58
  6.2 Noise and vibration............................................................................... 72
  6.3 Socio-economic .................................................................................... 85
  6.4 Traffic, transport and access ............................................................... 95
  6.5 Landscape, visual and urban design ..................................................... 102
  6.6 Aboriginal heritage ............................................................................. 105
  6.7 Non-Aboriginal heritage ..................................................................... 106
Appendices

Appendix A
Statutory Checklists

Appendix B
Stakeholder Representations

Appendix C
RTA Land Acquisition Information Guide

Appendix D
Ecological Assessment

Appendix E
Noise & Vibration Assessment

Appendix F
Statement of Heritage Impact

Appendix G
Air Quality & Climate Assessment

Appendix H
Contaminated Land and Groundwater Assessment

Appendix I
Urban and Landscape Design Concept Report
### Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1-1</td>
<td>Pacific Highway improvements on the Central Coast</td>
<td>5</td>
</tr>
<tr>
<td>Table 3-2</td>
<td>Summary of likely utilities in the study area</td>
<td>34</td>
</tr>
<tr>
<td>Table 3-3</td>
<td>Properties to be acquired by the proposal</td>
<td>35</td>
</tr>
<tr>
<td>Table 4-4</td>
<td>Wyong Shire Council zoning and permissibility</td>
<td>44</td>
</tr>
<tr>
<td>Table 4-5</td>
<td>Gosford City Council zoning and permissibility</td>
<td>44</td>
</tr>
<tr>
<td>Table 5-6</td>
<td>Community consultation activities undertaken to date</td>
<td>50</td>
</tr>
<tr>
<td>Table 5-7</td>
<td>Issues raised during community consultation</td>
<td>52</td>
</tr>
<tr>
<td>Table 5-8</td>
<td>Issues raised in submissions from government agencies</td>
<td>54</td>
</tr>
<tr>
<td>Table 6-9</td>
<td>Summary of methods used for the ecological assessment</td>
<td>58</td>
</tr>
<tr>
<td>Table 6-10</td>
<td>Threatened flora species with potential to occur in the study region</td>
<td>60</td>
</tr>
<tr>
<td>Table 6-11</td>
<td>Vegetation communities &amp; corresponding EECs identified in the study region</td>
<td>60</td>
</tr>
<tr>
<td>Table 6-12</td>
<td>Threatened fauna species occurring in the study region</td>
<td>64</td>
</tr>
<tr>
<td>Table 6-13</td>
<td>Quantitative assessment of construction noise at residences</td>
<td>72</td>
</tr>
<tr>
<td>Table 6-14</td>
<td>ECRTN criteria for operational traffic noise at residences</td>
<td>73</td>
</tr>
<tr>
<td>Table 6-15</td>
<td>Preferred/maximum PPV for continuous/impulsive vibration</td>
<td>75</td>
</tr>
<tr>
<td>Table 6-16</td>
<td>Acceptable intermittent vibration dose values (m/s(^{1.75}))</td>
<td>75</td>
</tr>
<tr>
<td>Table 6-17</td>
<td>Noise monitoring locations</td>
<td>76</td>
</tr>
<tr>
<td>Table 6-18</td>
<td>Measured traffic noise (dBA)</td>
<td>76</td>
</tr>
<tr>
<td>Table 6-19</td>
<td>Background noise levels, RBL (dBA)</td>
<td>78</td>
</tr>
<tr>
<td>Table 6-20</td>
<td>Construction L(_{Aeq}) noise management levels (dBA)</td>
<td>78</td>
</tr>
<tr>
<td>Table 6-21</td>
<td>Combined Sound Power Level</td>
<td>79</td>
</tr>
<tr>
<td>Table 6-22</td>
<td>Predicted daytime construction noise levels, L(_{Aeq})</td>
<td>80</td>
</tr>
<tr>
<td>Table 6-23</td>
<td>Predicted Noise Levels for Piling Construction, L(_{Aeq})</td>
<td>80</td>
</tr>
<tr>
<td>Table 6-24</td>
<td>Typical vibration emission levels from construction plant</td>
<td>80</td>
</tr>
<tr>
<td>Table 6-25</td>
<td>Residences where Acute Noise Levels are Exceeded</td>
<td>81</td>
</tr>
<tr>
<td>Table 6-26</td>
<td>Population structure</td>
<td>87</td>
</tr>
<tr>
<td>Table 6-27</td>
<td>Population projections – Ourimbah SPD and Wyong LGA</td>
<td>87</td>
</tr>
<tr>
<td>Table 6-28</td>
<td>Population projections – Lisarow SPD and Gosford LGA</td>
<td>87</td>
</tr>
<tr>
<td>Table 6-29</td>
<td>Need for assistance</td>
<td>88</td>
</tr>
<tr>
<td>Table 6-30</td>
<td>SEIFA index levels</td>
<td>88</td>
</tr>
<tr>
<td>Table 6-31</td>
<td>Modified Vehicle Access Arrangements</td>
<td>92</td>
</tr>
<tr>
<td>Table 6-32</td>
<td>Summary of crash data for the period 2003- 2008</td>
<td>96</td>
</tr>
<tr>
<td>Table 6-33</td>
<td>Level of Service criteria for intersections</td>
<td>97</td>
</tr>
<tr>
<td>Table 6-34</td>
<td>Projected two-way traffic volumes</td>
<td>100</td>
</tr>
<tr>
<td>Table 6-35</td>
<td>Results from the non-Aboriginal heritage assessment</td>
<td>106</td>
</tr>
<tr>
<td>Table 6-36</td>
<td>Construction dust deposition criteria</td>
<td>120</td>
</tr>
<tr>
<td>Table 6-37</td>
<td>Summary of NSW air quality objectives</td>
<td>120</td>
</tr>
</tbody>
</table>
### Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1-1</td>
<td>Location of the proposed Stage 3A upgrade and study area</td>
<td>6</td>
</tr>
<tr>
<td>Figure 3-2</td>
<td>Existing highway</td>
<td>18</td>
</tr>
<tr>
<td>Figure 3-3</td>
<td>Existing Cut Rock Creek infrastructure</td>
<td>20</td>
</tr>
<tr>
<td>Figure 3-4</td>
<td>Cut Rock Creek hydrological infrastructure</td>
<td>21</td>
</tr>
<tr>
<td>Figure 3-5</td>
<td>The proposal concept plan (1 of 3 figures)</td>
<td>24</td>
</tr>
<tr>
<td>Figure 3-6</td>
<td>The proposal concept plan (2 of 3 figures)</td>
<td>25</td>
</tr>
<tr>
<td>Figure 3-7</td>
<td>The proposal concept plan (3 of 3 figures)</td>
<td>26</td>
</tr>
<tr>
<td>Figure 3-8</td>
<td>Proposed bridge reconfiguration</td>
<td>30</td>
</tr>
<tr>
<td>Figure 3-9</td>
<td>Proposed culvert extension</td>
<td>30</td>
</tr>
<tr>
<td>Figure 3-10</td>
<td>Landscape cross-sections south of Ourimbah Street</td>
<td>31</td>
</tr>
<tr>
<td>Figure 3-11</td>
<td>Landscape cross-sections north of Ourimbah Street</td>
<td>31</td>
</tr>
<tr>
<td>Figure 3-12</td>
<td>Landscape cross-section between Ourimbah &amp; Teralba Sts</td>
<td>32</td>
</tr>
<tr>
<td>Figure 3-13</td>
<td>Landscape cross-section north of Teralba Street</td>
<td>32</td>
</tr>
<tr>
<td>Figure 3-14</td>
<td>Landscape cross-section at Cut Rock Creek north</td>
<td>33</td>
</tr>
<tr>
<td>Figure 3-15</td>
<td>Landscape cross-section at Lions Park</td>
<td>33</td>
</tr>
<tr>
<td>Figure 3-16</td>
<td>Proposed property acquisition locations (1 of 3 figures)</td>
<td>36</td>
</tr>
<tr>
<td>Figure 3-17</td>
<td>Proposed property acquisition locations (2 of 3 figures)</td>
<td>37</td>
</tr>
<tr>
<td>Figure 3-18</td>
<td>Proposed property acquisition locations (3 of 3 figures)</td>
<td>38</td>
</tr>
<tr>
<td>Figure 4-19</td>
<td>Zoning in Wyong Shire Council section of Stage 3A</td>
<td>43</td>
</tr>
<tr>
<td>Figure 4-20</td>
<td>Zoning in Gosford City Council section of Stage 3A</td>
<td>45</td>
</tr>
<tr>
<td>Figure 6-21</td>
<td>Distribution of <em>Melaleuca biconvexa</em> adjacent to the proposal</td>
<td>62</td>
</tr>
<tr>
<td>Figure 6-22</td>
<td>Vegetation communities identified adjacent to the proposal</td>
<td>63</td>
</tr>
<tr>
<td>Figure 6-23</td>
<td>Sensitive receiver catchments (coloured)</td>
<td>77</td>
</tr>
<tr>
<td>Figure 6-24</td>
<td>Hourly traffic data summary</td>
<td>95</td>
</tr>
<tr>
<td>Figure 6-25</td>
<td>Daily traffic profile north of Glen Road, Ourimbah</td>
<td>96</td>
</tr>
<tr>
<td>Figure 6-26</td>
<td>Crash locations along proposal route, 2003-2008</td>
<td>97</td>
</tr>
</tbody>
</table>

### Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 6-38</td>
<td>Summary of air quality monitoring at Wallsend/Newcastle</td>
<td>122</td>
</tr>
<tr>
<td>Table 6-39</td>
<td>Air quality modelling results, 2012</td>
<td>124</td>
</tr>
<tr>
<td>Table 6-40</td>
<td>Air quality modelling results, 2022</td>
<td>125</td>
</tr>
<tr>
<td>Table 6-41</td>
<td>Construction phase carbon sources and opportunities</td>
<td>127</td>
</tr>
<tr>
<td>Table 6-42</td>
<td>Carbon emissions reduction opportunities</td>
<td>127</td>
</tr>
<tr>
<td>Table 6-43</td>
<td>Scope of disturbance to acid sulfate soils</td>
<td>130</td>
</tr>
<tr>
<td>Table 6-44</td>
<td>Scope of disturbance to contaminated areas</td>
<td>131</td>
</tr>
<tr>
<td>Table 7-45</td>
<td>Summary of proposed safeguards</td>
<td>135</td>
</tr>
<tr>
<td>Table 7-46</td>
<td>Statutory licences and approvals likely to be required</td>
<td>146</td>
</tr>
<tr>
<td>Table 8-47</td>
<td>ESD principles</td>
<td>147</td>
</tr>
</tbody>
</table>
Figure 6-27  District precincts  
Figure 6-28  Lions Park, and southern entry to Ourimbah Township  
Figure 6-29  Topography in the vicinity of the proposal  
Figure 6-30  Waterways in and adjacent to the proposal  
Figure 6-31  1994 100 year ARI flood extent adjacent to the proposal  
Figure 6-32  Catchments for sediment control during construction  
Figure 6-33  Sensitive receiver catchments (coloured)

Revisions

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
<th>Prepared By</th>
<th>Approved By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draft 1</td>
<td>14/04/2010</td>
<td>Draft REF for comment based on RTA concept design, without economic, cost and quantity information from RTA</td>
<td>NP</td>
<td>JG</td>
</tr>
<tr>
<td>Draft 2</td>
<td>18/06/2010</td>
<td>Draft REF for RTA review</td>
<td>NP</td>
<td>JG</td>
</tr>
<tr>
<td>Draft 3</td>
<td>17/09/2010</td>
<td>Draft REF for RTA corporate review</td>
<td>AN</td>
<td>JG</td>
</tr>
<tr>
<td>Final</td>
<td>09/02/2011</td>
<td>Final REF for RTA corporate approval</td>
<td>AN</td>
<td>JG</td>
</tr>
<tr>
<td>Final 1</td>
<td>11/03/2011</td>
<td>Final REF for RTA corporate approval</td>
<td>AN</td>
<td>JG</td>
</tr>
<tr>
<td>Final 2</td>
<td>17/06/2011</td>
<td>Final REF</td>
<td>LT/AN</td>
<td>JG</td>
</tr>
</tbody>
</table>
## Glossary and Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Asphalt Concrete</td>
</tr>
<tr>
<td>AHD</td>
<td>Australian Height Datum</td>
</tr>
<tr>
<td>AHIMS</td>
<td>Aboriginal Heritage Information Management System</td>
</tr>
<tr>
<td>ARI</td>
<td>Average Recurrence Interval</td>
</tr>
<tr>
<td>ASS</td>
<td>Acid Sulfate Soil</td>
</tr>
<tr>
<td>ASSMAC</td>
<td>Acid Sulfate Soils Management Action Committee</td>
</tr>
<tr>
<td>CEMP</td>
<td>Construction Environmental Management Plan</td>
</tr>
<tr>
<td>DECCW</td>
<td>Department of Environment, Climate Change and Water (now OEH)</td>
</tr>
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<td>DOP</td>
<td>Department of Planning (now DOPI)</td>
</tr>
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<td>DOPI</td>
<td>Department of Planning and Infrastructure (formerly DOP)</td>
</tr>
<tr>
<td>DPI</td>
<td>Department of Primary Industries (formerly I&amp;I)</td>
</tr>
<tr>
<td>ECRTN</td>
<td>Environmental Criteria for Road Traffic Noise</td>
</tr>
<tr>
<td>EEC</td>
<td>Endangered Ecological Community</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EIS</td>
<td>Environmental Impact Statement</td>
</tr>
<tr>
<td>ENMM</td>
<td>Environmental Noise Management Manual</td>
</tr>
<tr>
<td>EP&amp;A Act</td>
<td>Environmental Protection and Assessment Act 1979</td>
</tr>
<tr>
<td>EPBC Act</td>
<td>Environmental Protection and Biodiversity Conservation Act 1999</td>
</tr>
<tr>
<td>ESD</td>
<td>Ecologically Sustainable Development</td>
</tr>
<tr>
<td>GPT</td>
<td>Gross Pollutant Trap</td>
</tr>
<tr>
<td>ICNG</td>
<td>NSW Interim Construction Noise Guideline</td>
</tr>
<tr>
<td>I&amp;I</td>
<td>Industry &amp; Investment NSW (now DPI)</td>
</tr>
<tr>
<td>KTP</td>
<td>Key Threatening Process</td>
</tr>
<tr>
<td>LALC</td>
<td>Local Aboriginal Land Council</td>
</tr>
<tr>
<td>LEP</td>
<td>Local Environmental Plan</td>
</tr>
<tr>
<td>LGA</td>
<td>Local Government Area</td>
</tr>
<tr>
<td>LoS</td>
<td>Level of Service</td>
</tr>
<tr>
<td>OEH</td>
<td>Office of Environment and Heritage (formerly Department of Environment, Climate Change and Water)</td>
</tr>
<tr>
<td>OHS</td>
<td>Occupational Health and Safety</td>
</tr>
<tr>
<td>PASS</td>
<td>Potential Acid Sulfate Soil</td>
</tr>
<tr>
<td>PMF</td>
<td>Probable Maximum Flood</td>
</tr>
<tr>
<td>RBL</td>
<td>Rating Background Level</td>
</tr>
<tr>
<td>REF</td>
<td>Review of Environmental Factors</td>
</tr>
<tr>
<td>RTA</td>
<td>NSW Roads and Traffic Authority</td>
</tr>
<tr>
<td>Seagull intersection</td>
<td>A type of three-way intersection allowing protected turning movements</td>
</tr>
<tr>
<td>SEPP</td>
<td>State Environmental Planning Policy</td>
</tr>
<tr>
<td>SIS</td>
<td>Species Impact Statement</td>
</tr>
<tr>
<td>SPD</td>
<td>Social Planning District</td>
</tr>
</tbody>
</table>
Executive summary

The NSW Roads and Traffic Authority (RTA) propose to widen a 1.7km section of the Pacific Highway between Lisarow and Ourimbah ("the proposal") on the Central Coast. The proposal is the HW10 Pacific Highway Lisarow to F3 Stage 3A (Lisarow to Ourimbah) Upgrade. The current single lane in each direction would be upgraded to a dual carriageway, with two lanes in each direction. This would improve traffic flow and increase safety for road users, including cyclists and pedestrians.

The RTA has prepared a review of environmental factors (REF) to assess the potential environmental impact of the proposal, which will be considered under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act). In determining the proposal and degree of impact the RTA will consider Sections 111 and 112 of the EP&A Act, and Clause 228 of the Environmental Planning and Assessment Regulation 2000.

The proposal

The proposal involves widening a 1.7 kilometre stretch of the Pacific Highway between Ourimbah Street, Lisarow, and Glen Road, Ourimbah, from the current two lanes to a four lane road (two lanes in each direction). The proposal would also include:

- Installing traffic lights at three existing intersections along this route.
- Installing pedestrian and cycleway facilities along the new road.
- Upgrading six bus bay facilities.
- Demolishing the existing bridge crossing and constructing twin single span bridges.
- Extending the existing culvert crossing and including a small weir at its exit point.
- Extending the existing levees along the edges of Cut Rock Creek at the exit to the culverts.
- Upgrading residential access near Teralba Street.
- Upgrading the light industrial service road near Walmsley Road.
- Installing a local roundabout at Lisarow Street and Teralba Street.

The proposal would tie in to the existing highway at both ends. The proposal works would occur primarily within the existing road corridor. The proposal is located on the floodplain of Cut Rock Creek and Bangalow Creek, although the southern end of the upgrade is at a higher elevation near the intersection of the Pacific Highway and Railway Crescent. The entire eastern edge of road corridor is bordered by the railway corridor close to the edge of the highway.

Need for the proposal

The Pacific Highway is the main north/south link between the F3 Freeway and Gosford, and currently carries around 29,000 vehicles per day from both regional and local areas. The single lane in each direction limits the capacity of this section of road, and leads to peak hour congestion along the highway.

There are three intersections with local roads (Ourimbah Street, Teralba Street and Walmsley Road) onto the Pacific Highway in this location. These access points do not currently have signalised access or acceleration/deceleration lanes onto the highway which limits traffic efficiency to and from the highway. A number of residential and commercial properties also have direct access onto the highway. These arrangements create safety issues along the current road alignment. There are also limited pedestrian and cyclist facilities in this area.

The proposal would assist in meeting priorities and targets in the NSW State Plan by upgrading the Pacific Highway to improve traffic and freight efficiency, and to improve road safety. It would also provide formalised pedestrian/cycle access and improve the functionality of local access to the area.

The proposal is identified in the State Infrastructure Strategy 2008-2018.

The proposal would assist the RTA in fulfilling the requirements of the Central Coast Regional Strategy by upgrading the Pacific Highway, improving pedestrian and cycleway facilities as well as providing safer use and access to public transport.
Options considered

A range of options were considered for the alignment and design of the proposed upgrade.

Three alternative route alignment options were considered, which were to ‘do minimum’, create an alternative road corridor, or widen the existing road alignment. After it was determined that the preferred option was to widen the existing road alignment, options for this proposal were considered, including:

- Widening the road alignment to the east or the west of the existing alignment.
- Potential intersection upgrade options.
- Potential upgrades to local roads.

The preferred option is to utilise the existing alignment, and generally widen the road to the:

- West from Ourimbah Street to just north of Cut Rock Creek bridge.
- East from just north of Cut Rock Creek bridge to Walmsley Road, to minimise impact on Lions Park.
- West from Walmsley Road to the north.

The preferred option also includes signalised intersections and local road access.

The preferred option is considered to achieve an acceptable balance between cost, safety, environmental impacts and constructability, while continuing to provide for the future transport needs of both the local and wider community.

Statutory and planning framework

In accordance with clause 94 of the State Environmental Planning Policy (Infrastructure) 2008, development consent under Part 4 of the EP&A Act is not required for roads and road infrastructure. Therefore the potential environmental impacts of the proposal have been assessed under Part 5 of the EP&A Act and are outlined throughout this REF.

In determining the proposal and degree of impact, the RTA will consider Sections 111 and 112 of the EP&A Act and Clause 228 of the Environmental Planning and Assessment Regulation 2000.

Community and stakeholder consultation

A community and stakeholder consultation program for the Stage 3A Lisarow to Ourimbah Pacific Highway upgrade has been developed. It has included community information sessions, meetings with the landowners, the community and state agencies, doorknocks, community updates and public displays at various stages of the proposal development.

Issues raised during consultation focussed on property acquisition, noise, flooding and flora and fauna. These issues are considered in section 5 and addressed throughout this REF. Consultation would continue through the display of this REF, and then throughout the detailed design and construction phases, particularly with landowners directly affected by the proposed upgrade.

Environmental impacts

Technical reports were undertaken to assess the potential impacts of the proposal on ecology, noise and vibration, Aboriginal heritage, non-Aboriginal heritage, air quality, soil contamination, water quality and flooding.

Ecology

There would be vegetation and habitat loss adjacent to the existing highway, though technical studies have concluded that vegetation removal would be unlikely to have a significant impact. There would be no significant impact on threatened flora and fauna species that were identified or may exist in the vicinity of the proposal.

There would be some disturbance of Cut Rock Creek as it crosses the highway in two locations. This disturbance would include the extension of the existing four cell culverts from 17 metres to 37 metres in length along the creek, and inclusion of a weir at the exit point. Given the low flows generally experienced in this area this extension would not impact movement of aquatic fauna through the area. The weir would also include a notch where fish passage would be maintained. An extension of the existing levees on the banks of the creek
would also be undertaken. In addition, the existing bridge crossing would be demolished and two single span bridges built to replace it. This would remove the pier structure from within the creek.

These changes are unlikely to have a significant impact on fish and aquatic species. Management measures would be implemented to minimise impacts to the creek, including temporary diversion of flows around construction activities to allow dry works.

**Noise**

Traffic noise would increase in the long term due to increased traffic on the Pacific Highway. There would be higher levels of noise and vibration during construction from construction equipment.

**Socio economic**

There would be full acquisition of four properties and partial acquisition of a further 13 properties to allow for the preferred road alignment. Some adjustments to property for utilities works would be required during construction. Adjustments would also be required to residential and commercial property access during construction. Access to residential and commercial properties along the highway would be altered as part of the proposal.

The proposal would have an overall positive economic value, as the quantified benefits are estimated to be double the expected costs.

**Traffic and access**

Improved road and intersection design would have positive long term impacts to through traffic, local residents, bus users, pedestrians and cyclists. There would be some restrictions on turning movements at local service roads for safety reasons, however local access to and from the highway would be improved via new intersections and access roads. There would be some minor traffic delays during the construction period.

**Soil and water**

Construction of the proposal could potentially degrade water quality and hydrology in the immediate parts of Cut Rock Creek, and downstream in Bangalow Creek. Soil and erosion control methods would be further developed during detailed design and implemented throughout construction. These would include, but not limited to, clean water diversions, sediment ponds, soil and erosion fencing, staggered clearing and diversion of creek flows to allow dry working areas.

Operation of the road may also increase the amount of pollutants discharged to Cut Rock Creek. During detailed design features to minimise run-off from the road surface potentially polluting waterways would be included. These would include vegetated swales, verges and table drains, median swales, soft landscaping treatments. Gross pollutant traps may also be included at low points prior to outlets into small water courses.

**Justification and conclusion**

The proposal would increase efficiency of traffic flow along the highway, provide improved safety and access for pedestrians, cyclists public transport users and motor vehicles, and satisfies the NSW State Plan, the State Infrastructure Strategy and the Central Coast Regional Strategy.

This REF identifies safeguards and best practice management measures to minimise the environmental impacts of the proposal. As a result of implementing these safeguards the proposal would have no significant impact on the environment.

**Display of the Review of Environmental Factors**

This review of environmental factors is on display for comment between 27 June and 29 July 2011. You can access the documents in the following ways:

**Internet** - The documents will be available as pdf files on the RTA website at:


**Display** - The documents can be viewed at the following locations:

- Gosford Motor Registry, Shops 11-12 Park Plaza, Corner William Street and Henry Parry Drive, Gosford.
Purchase - The documents are available for purchase in hard copy ($25) or CD ($10) at the RTA Central Coast Office, or by contacting the RTA Project Manager on (02) 4379 7009.

How can I make a submission?

To make a submission on the proposal, please email central_coast_office@rta.nsw.gov.au, or send your written comments to:

Chris Dransfield
Project Manager - Roads and Traffic Authority
Central Coast Office
Reply Paid 766
WOY WOY NSW 2256

Submissions must be received by the close of business on Friday 29 July 2011.

Privacy information

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

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

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

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

The information will be held by the Roads and Traffic Authority, Central Coast Office, The Pavilion, Upper Level, 29 George St, Woy Woy.

What happens next?

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

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

If the proposal is determined, the RTA proceeds with final design and tenders are called for construction of the project.

If you have any queries, please contact the RTA Project Manager on (02) 4379 7009.
1 Introduction

1.1 Background

The Pacific Highway (HW10) is the main north/south link between the F3 Freeway and Gosford, and currently carries around 29,000 vehicles per day from regional and local areas.

The NSW Roads and Traffic Authority (RTA) is upgrading the Pacific Highway between Lisarow and the F3 Freeway in stages as shown in Table 1-1. Funding for Pacific Highway upgrade works on the Central Coast is provided by the NSW Government as part of the State Budget process. Stages 1 and 2 have been completed. Stage 3A, highlighted in the below table, is the proposal being considered and assessed as part of this REF.

Table 1-1 Pacific Highway improvements on the Central Coast

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>Upgrade to the Pacific Highway / Dog Trap Road intersection to improve safety, assist traffic flow during peak periods, and ease congestion outside the Ourimbah Primary School.</td>
<td>Complete</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Upgrade to widen the Pacific Highway between Glen Road and Burns Road, Ourimbah from one to two lanes in each direction.</td>
<td>Complete</td>
</tr>
<tr>
<td>Stage 3 (3A)</td>
<td>Upgrade to widen the Pacific Highway between Ourimbah Street, Lisarow and Glen Road, Ourimbah from one to two lanes in each direction.</td>
<td>Proposed – concept design</td>
</tr>
<tr>
<td>Stage 3 (3B)</td>
<td>Upgrade to widen the Pacific Highway from Ourimbah Street, Lisarow up to and including the intersection of Railway Crescent and Pacific Highway at Lisarow.</td>
<td>Proposed – strategic design</td>
</tr>
<tr>
<td>Stage 4</td>
<td>Upgrade of main road network from intersection of Manns Road and Narara Creek Road at Narara to the intersection of Railway Crescent and Pacific Highway at Lisarow. Proposed upgrade to provide two lanes in each direction and use either the existing Pacific Highway corridor or a new road corridor along the Narara Valley.</td>
<td>Proposed – route selection</td>
</tr>
</tbody>
</table>

Each of the above stages are interconnected along the length of the Pacific Highway. The upgrade of the intersection at Pacific Highway and Railway Crescent at the southern end of stage 3 is required to connect to the northern end of stage 4. When concept designs for stage 3 began, the preliminary design for stage 4 had not commenced. In order to proceed with the design for most of stage 3, this stage was split into stage 3A and stage 3B. The concept design for Stage 3A has been undertaken and this REF outlines the proposal. The RTA will develop and assess Stage 3B as part of a separate assessment once the route for stage 4 has been determined.

1.2 Proposal identification

The RTA proposes to upgrade 1.7 kilometres of the Pacific Highway between Ourimbah Street, Lisarow and Glen Road, Ourimbah (refer to Figure 1-1). The proposal is the HW10 Pacific Highway Lisarow to F3 Stage 3A (Lisarow to Ourimbah) Upgrade.

The upgrade would include widening the road from the current single lane in each direction to two lanes in each direction. The alignment would follow the existing alignment of the highway and would primarily remain within the existing road corridor. Figures 3-5 to 3-7 illustrate the proposed concept plan for this proposal. The main features of the proposal would include:

- A four lane (two lanes in each direction) divided carriageway with a median strip (including a median safety fence between Walmsley Road and Glen Road).
- Three new signalised intersections with full access in all directions and pedestrian crossings at Ourimbah Street, Teralba Street and Walmsley Road.
- An off-road shared pedestrian and cycle path.
- Road shoulders sufficient for cyclists and vehicle breakdowns.
- Six upgraded bus stop facilities with indented bus bays.
- Demolition of the existing multi-span bridge crossing of Cut Rock Creek (north). The provision of two new parallel single span bridges over Cut Rock Creek (north).
- Extension of the existing culvert over Cut Rock Creek (south).
- Construction of a weir and levees at the exit to Cut Rock Creek culvert extension.
- Upgrade a residential access road near Teralba Street
- Upgrade a light industrial service road near Walmsley Road.
- Install a local roundabout at the intersection of Lisarow Street and Teralba Street.

Figure 1-1  Location of the proposed Stage 3A upgrade and study area
(Source: Hyder GIS)
The proposal is located within the RTA’s Hunter Region (Central Coast Office) and falls within both Wyong Shire Council (north of Teralba Street) and Gosford City Council (south of Teralba Street) local government areas (LGA). The land uses within this area are predominantly urban development with some semi-rural fringes along the corridor. Running parallel to the road corridor is the main central coast to Sydney railway line and a local cemetery is at the southern edge of the proposal. The road crosses Cut Rock Creek in two locations.

The strategic cost estimate of the stage 3A proposal is around $100 million. Subject to funding approval and the completion of the planning process, construction would commence in 2013 and is estimated to take up to two years to complete.

1.3 Purpose of this REF

This review of environmental factors has been prepared by Hyder Consulting on behalf of RTA Hunter Region, Central Coast Office. For the purposes of these works, the RTA is the proponent and determining authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

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

The description of the proposed works and associated environmental impacts have been undertaken in context of clause 228 of the Environmental Planning and Assessment Regulation 2000, the *Threatened Species Conservation Act 1995* (TSC Act), the *Fisheries Management Act 1994* (FM Act), and the Australian Government’s *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In doing so, the REF helps to fulfil the requirements of section 111 of the EP&A Act, that the RTA examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for approval to be sought under Part 3A of the EP&A Act.
- The significance of any impact on threatened species as defined by the TSC Act and/or FM Act, in section 5A of the EP&A Act and therefore the requirement for a Species Impact Statement.
- The potential to significantly impact a matter of national environmental significance or Commonwealth land and the need to make a referral to the Australian Government Department of Sustainability, Environment, Water, Population and Communities for a decision by the Commonwealth Minister for the Environment, Heritage and the Arts on whether assessment and approval is required under the EPBC Act.
2 Need and options considered

2.1 Strategic need for the proposal

2.1.1 Relevant Strategies and Plans

**NSW State Plan 2010**

The *NSW State Plan – Investing in a Better Future* identifies priorities and targets for delivering services for NSW. The State Plan identifies a number of priorities including ‘delivering better transport and liveable cities’.

Targets within this priority include:

- Improve the road network.
- Improve road safety.
- Increase walking and cycling.
- Grow centres as functional and attractive places to live, work and visit.

These targets identify the need to upgrade the Pacific Highway and to improve road safety outcomes by upgrading roads. They also identify the need to accommodate population growth in major regional centres and the importance of establishing shared pedestrian/cycle paths to provide for the community.

The proposal would assist in meeting these priorities and targets by upgrading the Pacific Highway to improve traffic and freight efficiency and to improve road safety. It would also provide formalised pedestrian/cycle access and improve the functionality of the local area through the provision of local access. The *NSW State Plan* therefore supports this proposal.

**State Infrastructure Strategy 2008 - 2018**

The *State Infrastructure Strategy 2008-2018* is a 10–year strategy to plan and fund infrastructure that the NSW Government delivers. It is guided by Government agencies’ asset management plans, and forms the link between infrastructure plans detailed in each State budget, the 10–year State Plan, and the 25–year metropolitan and regional strategies.

The proposal is listed in the strategy as item 27 in the Central Coast section for planned road upgrades. It includes a commitment from the Government to continue to develop Gosford as a Regional City, and to develop the Central Coast into a more self-sustained economy. This proposal would assist in this by providing adequate road access into the region from the F3.

**Central Coast Regional Strategy**

The *Central Coast Regional Strategy* sets out land use plans for the Central Coast and includes the Gosford City and Wyong Shire local government areas. The regional strategy, released in June 2008, contains policies and actions to plan for the regions projected population and employment growth to 2031. With an existing population of just over 300,000 the Central Coast is one of the fastest growing areas in NSW.

The strategy identifies an action for the RTA to continue to plan and implement upgrades to the Pacific Highway, the Central Coast Highway, Terrigal Drive, Avoca Drive and Sparks Road. This includes incorporating bus priority and cycleway initiatives where justified and feasible.

The proposal would assist in fulfilling the requirements of the *Central Coast Regional Strategy* as it would upgrade the Pacific Highway. It also incorporates some pedestrian and cycleway facilities as well as providing safer use and access to bus stops along the route.
2.1.2 Road network

The Pacific Highway between Gosford and the F3 is the main north/south link for road transport in this area and currently carries around 29,000 vehicles per day. There is currently only one travel lane in each direction between Lisarow and Ourimbah which limits the capacity of the road.

Congestion occurs at three main intersections with local roads and a number of access points from residential and commercial properties onto the highway during peak periods. There are currently no access points or acceleration/deceleration lanes from these intersections, which creates an inefficient network with delays and intermittent stopping. The proposal would include widening the existing highway to create two travel lanes in each direction separated by a median strip. This would improve the carrying capacity and efficiency of the road. In addition access onto the highway from the three intersections would be improved by the installation of traffic lights providing for regular and safe access to and from the highway.

Currently there are limited provisions for pedestrians and cyclists. The proposal would provide signalised pedestrian access at the three local road intersections along the highway. In addition a pedestrian/cyclist shared path would be installed for the length of the proposal and shoulder widths would provide for cyclists.

There are informal provisions in the road shoulder for buses to pick up and drop off passengers. The proposal would upgrade bus facilities to include bus bays off the main road surface. This would allow safe bus access and would reduce interruptions to the flow of traffic.

The proposal would therefore increase efficiency of traffic flow along the highway, and provide improved safety and access for pedestrians, cyclists and motor vehicles. The proposal would also provide for some future growth in traffic demand in the area.

If the proposal does not proceed, the safety and accessibility for pedestrians, cyclists and road users, as well as the capacity of the infrastructure, would continue to decline due to projected increases in traffic volumes.

2.2 Proposal objectives

The proposal is a part of a broader strategy to upgrade the Pacific Highway on the Central Coast, which is the main north/south link between the F3 Freeway and Gosford.

The overall objectives for the proposal are to:

1. Reduce congestion on the urban arterial road network between Lisarow and the F3 Freeway by increasing the capacity of the road and enabling it to be able to perform with reasonable efficiency 20 years after opening with acceptable levels of service.
2. Reduce the number of crashes and improve safety for pedestrians, cyclists and motorists.
3. Improve accessibility for all road user groups including motorists, pedestrians, cyclists, public transport and road freight operators.
4. Minimise the impact on the environment along the route.
5. Provide opportunities and mechanisms for the timely involvement and contribution of the community and stakeholders to project outcomes.
6. Provide the best value for money solution to achieve the objectives.

2.3 Methodology for selection of preferred option

In 2009 the NSW State Government announced the RTA would upgrade the Pacific Highway between Ourimbah and Narara as part of the broader strategy to upgrade the Pacific Highway on the Central Coast.

Investigations and design development for stage 3 commenced in March 2009. The upgrade of the intersection at Pacific Highway and Railway Crescent at the southern end of stage 3 is
required to connect to the northern end of stage 4. When concept designs for stage 3 began, designs for stage 4 had not commenced. In order to proceed with plans for most of stage 3, this stage was split in two, stage 3A and stage 3B.

It was determined that the upgrade of the road would need to primarily follow the existing alignment and could not be moved to an alternative road corridor. This is further discussed in section 2.4. At this stage the proposal was introduced to the local community. Feedback was sought on inputs to the design process in order to gain an understanding of community values in the local area, and the concerns and needs in relation to the road. This included:

- A community update letterbox drop with a ‘Have your say’ feedback form was sent to 2000 residential and business properties adjacent to the proposal in March 2009.
- Community doorknock targeting properties directly adjacent to the proposal in March 2009.
- Community information session on 8 April 2009 at Niagara Park Community Hall.

The outcomes from this consultation are outlined in more detail in section 5.

Utilising the feedback from this community consultation and preliminary environmental and engineering constraints, the concept design for the road alignment was developed. This included utilising the existing alignment, and generally widening to the east or west of the existing road. The proposal was broken up into three lengths and intersections and options were developed for each. The options considered are outlined in section 2.4.3. Each option was assessed against how well it met the project objectives.

The principles of ecologically sustainable development (ESD) were integrated in this criteria and were included in the decision-making process.

A value engineering workshop was held in May 2009 where option alternatives were presented. In attendance at this workshop were the design team and the RTA. The options were reviewed by workshop participants to refine and add value to the design, to make recommendations on the preferred option, or identify other options that may not have been considered.

Based on information gathered throughout the community consultation, preliminary investigations and the workshop the preferred option for each section of the proposal was chosen. These were then combined to create the full length preferred option at that time. The preferred option was widening both sides of the existing road, except from Cut Rock Creek bridge to Lions Park where the alignment was predominantly to the east (referred to as the ‘eastern option’). This preferred option was presented to the community for consideration in the following ways:

- Feedback forms available for comment from June – August 2009.
- Community information session on 29 June 2009 at Niagara Park Community Hall.
- Shop front open days on 9 and 11 July 2009.

The outcomes from this consultation were used to refine the preferred option at that time, as described in section 2.4.3.

Further risk and engineering workshops were then held in November and December 2009 with participants from the design team and the RTA. These workshops further assessed design alternatives and options, leading to the selection of a revised preferred option for the road alignment, which is described in this REF. The revised preferred option was to utilise the existing alignment, and generally widen the road to the:

- West from the Lisarow Cemetery to just north of Cut Rock Creek bridge.
- East from just north of Cut Rock Creek bridge to Walmsley Road, to minimise impact on Lions Park.
- West from Walmsley Road to the north.

This was referred to as the ‘western option’ and is now the preferred option being assessed.
This preferred option was presented to the community for consideration in the following ways:

- Community Update newsletter circulated on 30 August 2010.
- Display of the preferred option from 30 August to 24 September 2010 at the Gosford Motor Registry, Wyong Motor Registry, and the RTA Central Coast office at Woy Woy.

The outcomes from this consultation are presented in more detail in section 5.

## 2.4 Options considered

Three alternative route alignment options were considered as part of the preliminary stages of developing the proposal. These options were the ‘do minimum’ option, create an alternative road corridor, and widening the existing road alignment.

All of the options outlined above have been outlined below.

### 2.4.1 ‘Do minimum’ option

A base case or ‘do nothing’ option was considered. This option was rejected as it would not satisfy the relevant strategic transport plans outlined in section 2.1.1. The base case option would also not meet the project objectives as outlined below.

- A base case option would not reduce congestion on this road network or increase the capacity of the road to perform with reasonable efficiency for the next 20 year period.
- This option would not improve road safety for pedestrians, cyclist or motorists.
- Retaining the existing road infrastructure would not improve accessibility for motorists, pedestrians, cyclists, public transport or road freight operators.

A base case option would also impact the effectiveness of adjacent upgrades of the Pacific Highway in this location. As this proposal is part of a larger strategy to upgrade the Pacific Highway between Lisarow and the F3, to do nothing would lead to a bottleneck where the adjacent two lanes in each direction would need to converge to one through this location.

A base case option was not considered further.

### 2.4.2 Alternative corridor options

The purpose of this proposal is to upgrade the Pacific Highway between Lisarow and Ourimbah. Upgrading or creating an alternative route corridor in an already highly developed area was not considered feasible or reasonable to undertake due to the additional works, costs and environmental and social impacts it would cause.

This option was not considered further.

### 2.4.3 Upgrade existing road alignment

The purpose of this proposal was to upgrade the Pacific Highway between Lisarow and Ourimbah. The proposal is designed to tie into two other stages of upgrades along this stretch of road. Upgrading the existing road alignment between Lisarow and Ourimbah was the most feasible option that would meet the project objectives.

After it was determined that the preferred corridor option was to upgrade the existing road alignment, a number of options for this proposal were considered for different aspects of this proposal. These included:

- Widening the road alignment to the east or to the west of the existing alignment
- Options for upgrades to the existing intersections with the Pacific Highway.
- Potential upgrades to local roads.

The options considered for each of these components are outlined below.
2.4.3.1 Widening existing highway options

Consideration of widening the existing road alignment was broken into three main sections. These sections were then each considered individually to determine the impacts and benefits of widening the road with the either the eastern or western option.

A description of options for widening the Pacific Highway in each of these three sections is considered below.

Highway from Lisarow Cemetery to Cut Rock Creek bridge

Two main options were considered:

- WESTERN OPTION – Provide two lanes in each direction by widening predominantly to the west.
- EASTERN OPTION – Provide two lanes in each direction by widening on both sides of the existing road, and aligning to the east approaching Cut Rock Creek bridge.

Both of these options provided similar levels of road safety, road capacity and local access, but differed in terms of environmental impact and cost. In mid-2009 the eastern option was preferred as it:

- Minimised property acquisition costs and impact on private property.
- Minimised noise and visual impacts to residents along the Pacific Highway.

Further assessment identified the western option as the preferred option, as it had the following advantages over the eastern option:

- Avoided impact on the existing large diameter water main, and high voltage power lines, that run along the eastern side of the road alignment.
- Avoided impact on railway property that may be used for future rail duplication.

The western option met project objectives relating to safety, road capacity, accessibility, environment and value for money, and is the preferred option.

Highway over Cut Rock Creek bridge

Two main options were considered:

- WESTERN OPTION – Construct a new bridge to the west of the existing bridge to provide two northbound lanes. Replace the existing bridge with a new single span bridge to accommodate the new southbound carriageway.
- EASTERN OPTION – Construct a new bridge to the east of the existing bridge to provide two southbound lanes. Modify the existing bridge to accommodate the new northbound carriageway.

Both of these options provided similar levels of road safety, road capacity and local access, but differed in terms of environmental impact and cost. In mid-2009 the eastern option was preferred as it:

- Minimised noise and visual impacts to residents in Robert Holl Drive and the Pacific Highway.
- Minimised the proposed earthworks footprint near the freshwater wetland Endangered Ecological Community (EEC), west of the current road reserve.
- Reduced property acquisition costs.
- Potential reduced bridge construction costs.

Further assessment identified the western option as the preferred option, as it had the following advantages over the eastern option:

- Avoided impact on the existing large diameter water main, and power lines, running along the eastern side of the road alignment.
- Avoided realignment of adjacent parts of Cut Rock Creek.
- Allowed for replacement of the existing Cut Rock Creek bridge, which was considered to have a limited residual life.
- Avoided impact on railway property that may be used for future rail duplication.

The western option met project objectives relating to safety, road capacity, accessibility, environment and value for money, and is the preferred option.

**Highway from Cut Rock Creek bridge to Glen Road**

Two options were considered for the highway alignment from Cut Rock Creek bridge to Glen Road:

- **WESTERN OPTION** – Provide two lanes in each direction by widening on both sides of the existing road, predominantly towards the west. Retain the industrial service road with minor modifications to access arrangements.
- **EASTERN OPTION** – Provide two lanes in each direction by widening on both sides of the existing road, with the industrial service road being partly removed and access arrangements altered.

Both of these options were constrained by the Cut Rock Creek bridge crossing, minimising impact on Lions Park and the need to meet the existing alignment at Glen Road. Both options provided similar levels of road capacity, local access, road safety, environmental impact and cost. In mid-2009 the eastern option was preferred as it allowed Lions Park to be fully retained.

Discussions with the affected land owner in September 2009 resulted in the ‘western option’ being developed. The ‘western option’ was then selected as the preferred option, which resulted in a minor impact on Lions Park, but retained the industrial service road fronting the highway with improved local access arrangements.

The ‘western option’ met project objectives relating to safety, road capacity, accessibility, environment and value for money, and is the preferred option.

**2.4.3.2 Intersection upgrade options**

Three intersections along the proposed alignment were required to be upgraded in order to meet the project objectives by improving road safety and efficiency. A number of options were considered for each intersection, these are outlined below. Note that unsignalised right turns across two lanes were not considered, based on safety advice from the RTA Centre for Road Safety.

**Ourimbah Street intersection**

Three different intersection options were considered for the Ourimbah Street intersection. A roundabout was not considered due to the limited available space and safety concerns for pedestrians and cyclists. A roundabout in this location would not be effective from a traffic management perspective due to the unbalanced nature of traffic flows.

- **Option 1 - Signalised ‘T’ intersection.**
  
  The benefits of this option were primarily safety for pedestrians and cyclists, pedestrian access to bus services on the eastern side of the Pacific Highway, and capacity to handle forecast traffic levels. The disadvantage of this option was additional costs of property acquisition and signals.

  There was support for signalised intersections, and in particular pedestrian crossings, in stakeholder feedback.

  This option met project objectives relating to safety, road capacity, accessibility, environment and value for money, and is the preferred option.

- **Option 2 - Unsignalised left-in and left-out only combined with service road connecting Teralba Street.**
The benefit of this option was primarily cost savings due to reduced property acquisition and signals, on the basis that Ourimbah Street and Teralba Street could be connected via a service road. The disadvantages of this option were reduced safety for pedestrians and cyclists and reduced access to bus services.

This option met project objectives relating to environment, road capacity and value for money, but not safety or accessibility. This option was not considered further.

- Option 3 - Unsignalised left-in only intersection combined with service road connecting to Teralba Street.

The benefit of this option was primarily cost savings due to reduced property acquisition and signals, on the basis that Ourimbah Street and Teralba Street could be connected via a service road. This option had reduced safety for pedestrians and cyclists, reduced pedestrian access to bus services, and reduced capacity to handle forecast traffic levels.

This option met project objectives relating to environment and value for money, but not safety, road capacity or accessibility. This option was not considered further.

**Teralba Street intersection**

Two different intersection options were considered for the Teralba Street intersection:

- Option 1 - Signalised ‘T’ intersection.

  The benefits of this option were primarily safety for pedestrians and cyclists, pedestrian access to bus services on the eastern side of the Pacific Highway, and capacity to handle forecast traffic levels. A disadvantage of this option was the additional cost of signals.

  There was support for signalised intersections, and in particular pedestrian crossings, in stakeholder feedback.

  This option met project objectives relating to safety, road capacity, accessibility, environment and value for money, and is the preferred option.

- Option 2 – Roundabout combined with a pedestrian overpass.

  The benefits of this option were pedestrian access to bus services and good local access by allowing u-turn movements. This option had significantly reduced safety for cyclists, required significant property acquisition, would not be effective from a traffic management perspective due to the unbalanced nature of traffic flows, and had higher costs due to increased property acquisition and construction of the pedestrian overpass.

  This option met project objectives relating to environment and accessibility, but not value for money, safety or road capacity. This option was not considered further.

**Walmsley Road intersection**

Three different intersection options were considered for the Walmsley Road intersection:

- Option 1 - Signalised ‘T’ intersection.

  The benefits of this option were primarily safety for pedestrians and cyclists, pedestrian access to bus services on the eastern side of the Pacific Highway, capacity to handle forecast traffic levels. Disadvantages of this option were additional cost for signals and reduced local road access.

  This option met project objectives relating to safety, environment, road capacity and value for money, but not for local access. This option was not considered further.

- Option 2 - Signalised 4-way intersection with new access road and cul-de-sac in the industrial land opposite Walmsley Road.

  The benefits of this option were primarily safety for motorists, pedestrians and cyclists, pedestrian access to bus services on the eastern side of the Pacific Highway, capacity to handle forecast traffic levels, and improved local access due to increased turning
movements. The disadvantage of this option was additional costs of property acquisition and signals.

There was support for signalised intersections, and in particular pedestrian crossings, in community feedback.

This option met project objectives relating to safety, road capacity, accessibility, environment and value for money, and is the preferred option.

- Option 3 - Roundabout.

The benefits of this option were primarily cost savings due to reduced property acquisition and signals. Other benefits were good local road access by allowing u-turn movements. This option had significantly reduced safety for pedestrians and cyclists, reduced pedestrian access to bus services, would not be effective from a traffic management perspective due to the unbalanced nature of traffic flows, and impacted on Lions Park.

This option met project objectives relating to value for money and local road accessibility, but not environment, safety, road capacity or pedestrian accessibility. This option was not considered further.

2.4.3.3 Local road upgrade options

Local road connection between Ourimbah Street and Teralba Street

Local road connections were considered between Ourimbah Street and Teralba Street to allow removal of one set of traffic signals on the highway. Options included:

- Option 1 - Connect Ourimbah Street to Teralba Street via a connection of Lisarow Street south to Lisarow Street (north), currently separated by Cut Rock Creek.
- Option 2 - Connect Ourimbah Street to Teralba Street via a new local road to the west parallel to Lisarow Street.
- Option 3 - Connect Ourimbah Street to Teralba Street via a new local road over Cut Rock Creek and along existing access road, then connected via Lisarow Street (north) to Teralba Street.
- Option 4 - Connect Ourimbah Street to Teralba Street via a connection from Brands Place over Cut Rock Creek to Lisarow Street (north) and then Teralba Street.

The benefits of these options were improved traffic flow on the Pacific Highway by removing the need to signalise the Ourimbah Street intersection, and improving local road access.

Disadvantages of these options were additional cost of property acquisition and creek crossings, flooding impacts from creek crossings, impacts on private property and threatened species, and pedestrian safety during flood events.

These options did not meet project objectives relating to environment, safety or value for money, and were not considered further. Signalised intersections were preferred at Ourimbah Street and Teralba Street.

Residential access road near Teralba Street

There is an existing access road south from Teralba Street parallel with the highway that services a number of properties located between Lisarow Street and the highway.

Changes to the highway alignment at this location as part of the preferred concept restricts safe access to the service road. Alternative service road options were therefore considered to maintain safe access. These included:

- Option 1 - One way service road, with exit northbound only, north of Cut Rock Creek and entry back onto highway just south of Teralba Street intersection.
- Option 2 - A single left-in and left-out entry/exit point at the current bus stop location (and old access road connection point) with connection to existing access road.
- Option 3 - A one way service road (northbound) between Ourimbah Street and Teralba Street, parallel to the highway, allowing local road connections and direct property access.

- Option 4 - A two way service road connected from Lisarow Street north to existing service road, but not connected directly to Teralba Street.

- Option 5 - A two way service road with entry and exit point off Teralba Street and cul-de-sac just north of Cut Rock Creek culvert. This option is similar to the existing access road arrangement.

Disadvantages of options 1-4 were additional cost of property acquisition, impacts on private property and threatened species, and safety for pedestrians and cyclists on the shared path. Options 1-4 did not meet project objectives relating to environment, safety or value for money, and were not considered further.

Option 5 met project objectives relating to safety, road capacity, accessibility, environment and value for money, and is the preferred option. Option 5 is similar to the existing arrangement, however would:

- Restrict access for heavy vehicles approaching from the south, which would be required to turn at the Walmsley Road intersection and then turn right into Teralba Street.

- Not allow for a right turn out of the access road on to the highway, and vehicles would be required to use a local roundabout at the intersection of Teralba Street and Lisarow Street to return to the highway.

2.5 Summary of Preferred Option

A combination of the above options for each aspect of the proposal was adopted as the preferred option. A summary of these aspects can be found below in section 3.
3 Description of the proposal

The proposal for the Stage 3A concept design is a dual carriageway upgrade of the Pacific Highway, comprising the following key features:

- Widening of the alignment of the existing road from two lanes (one in each direction) to four lanes (two in each direction). The road would be widening in accordance with the following options:
  - From Lisarow Cemetery to Cut Rock Creek bridge the highway would be widened to the western side of the existing road alignment.
  - Over Cut Rock Creek the highway would be widened to western side of the existing alignment.
  - From Cut Rock Creek to Glen Road the highway would be widened to the western side of the existing alignment.

- Upgrading of three intersections which would include:
  - Upgrading the Ourimbah Street intersection with a signalised T-intersection (option 1). Pedestrian access would be provided for at all crossings.
  - Upgrading the Teralba Street intersection with a signalised T-intersection (option 1). Pedestrian access would be provided for at all crossings.
  - Upgrading the Walmsley Street intersection with a signalised 4-way intersection with new access road and cul-de-sac in the industrial land opposite Walmsley Road (option 2). Pedestrian access would be provided at all crossings.

- Upgrades to local roads and resident access including:
  - A two-way service road with an entry and exit point off Teralba Street (option 5 – Resident access road near Teralba Street).
  - A cul-de-sac just north of Cut Rock Creek culvert (option 5 – Resident access road near Teralba Street).

A number of additional aspects have also been included as part of the preferred option that did not require an options assessment.

- A new access into the industrial zone by retaining and modifying the service road fronting the highway and connecting a new perpendicular access road.
- A new southbound entry ramp and a u-turn facility opposite Walmsley Road for highway traffic.
- A roundabout at the intersection of Lisarow Street and Teralba street.
- Off road shared pedestrian and cycle path.
- Street lighting and lighting of the shared path.
- Upgraded bus stop facilities.
- Two parallel bridges over Cut Rock Creek south of Walmsley Road, with one bridge accommodating a new pedestrian/cycleway adjacent to the northbound carriageway.
- Extension to existing four cell culverts over Cut Rock Creek north of Ourimbah Street.

A detailed description of these aspects is provided in section 3.2 and the concept design is shown in Figure 3-5 to Figure 3-7 below. These design features would be subject to further refinement at the detailed design stage.
3.1 Existing road and infrastructure

3.1.1 Pacific Highway

Within the study area, the Pacific Highway comprises a two-way single carriageway with one lane in each direction. The posted speed limit for the study area is either 60 or 70km/h, with the higher limit in place along the more rural, open section of the highway between Lisarow and Ourimbah. Figure 3-2 shows photos of the existing highway.

![Entry to Ourimbah (looking north)](image)

![Lions Park, Ourimbah](image)

![Opposite Lions Park, Ourimbah (looking north)](image)

![Cut Rock Creek Bridge, Ourimbah (looking north)](image)

![Intersection with Teralba Street (looking south)](image)

![Adjacent to Lisarow Cemetery (looking south)](image)

Figure 3-2 Existing highway

Three local roads (Ourimbah Street, Teralba Street and Walmsley Road) form T-intersections with the highway along the length of the study area. There are currently no traffic signals, roundabouts or pedestrian crossings, and no provisions for overtaking. There are sheltered turning lanes at Ourimbah Street, Teralba Street and Walmsley Road for right hand turns to and from the highway.
The existing road verge is the only suitable area for car parking along the highway. There are no formed pedestrian or cycle paths, and only limited provision for pedestrians and cyclists along the road shoulder and verges. There are no designated crossing points for pedestrians.

The area is characterised by a long flat alluvial valley with surrounding sandstone ridges. The existing road was constructed along the valley floor except to the south, where it rises gently as it intersects the ridgeline and approaches the rail overbridge at Railway Crescent.

The entire length of the highway between Glen Road, Ourimbah and Railway Crescent, Lisarow has been elevated due to construction of the highway and the adjacent Main Northern Railway Line. The existing road pavement along the highway consists of seals and asphalt concrete over gravel, silt and sand. There are a number of improvements including patching and widening of the local road intersections, which were constructed using heavily bound base or slag and asphaltic concrete (RTA, 2007).

3.1.2 Land uses

Existing land uses within the study area comprise a mixture of residential, commercial and recreational uses.

The main commercial area is located around the northern end of the proposal at Ourimbah, primarily between Walmsley Road and Glen Road. Commercial properties are located on both the western and eastern sides of the highway, with frontage onto the highway, including the Metro Petroleum Service Station (eastern side) and the Tall Timbers Hotel (western side).

Lions Park is a recreation area that is valued by the community. It is at the intersection of Walmsley Road and the highway, and was formerly the old alignment of the highway. The park has car parking facilities, playgrounds and tables.

There are residential areas along the highway in Ourimbah to the north of the Walmsley Road intersection, and between Teralba Street and Lisarow Cemetery. Houses along the highway gain access to and from their properties via the highway, apart from those on a small service road running south from Teralba Street.

Lisarow Cemetery, on the western side of the highway between Railway Crescent and Ourimbah Street, has local historic and social significance as a mid-19th century cemetery associated with the early settlement of the district. Set above the highway, the cemetery is an important feature of the landscape.

3.1.3 Pedestrian and cyclist facilities

There are no formed footpaths, and pedestrians use either the gravel edges, grassy verges of the road or the road pavement. There are currently no formalised crossing facilities to traverse the highway from east to west, to access bus stops, commercial properties or the Baileys Road pedestrian bridge over the railway. There are currently no formalised cycle ways, and cyclists use the shoulder of the road.

Access across the highway from residential areas to bus stops on the eastern side of the highway is difficult during peak hours, as there are no formal crossing facilities. Crash data indicates that there have been two fatalities along this section of the highway from 2003 to 2008, both involving pedestrians attempting to cross the highway.

3.1.4 Public transport

The highway serves as the part of the route for one bus service between Gosford and Tuggerah - Busways Route 36. Busways Route 37 also runs between Gosford and Tuggerah, however this route runs to the east of the study area through Wyoming Rd & Settlers Park.

There are seven existing bus stops located on both sides of the highway. Northbound stops are located at Lisarow Cemetery, and near the Ourimbah Street, Teralba Street and Walmsley Road intersections. Southbound stops are located near the Ourimbah Street, Teralba Street,
and Walmsley Road intersections. Two of the bus stops have bus shelter facilities, however others are only signposted.

The highway runs parallel to the Main Northern Railway Line which runs both inter-city (Newcastle – Sydney) and suburban trains (Central Coast Line). The existing train stations at Ourimbah and Lisarow are outside the limits of Stage 3A.

### 3.1.5 Cut Rock Creek

Cut Rock Creek is considered a Class 2 waterway according to the classification in Fairfull & Witheridge (2003). A Class 2 waterway is considered to provide moderate fish habitat.

Cut Rock Creek drains east to Bangalow Creek. Bangalow Creek flows into Ourimbah Creek several kilometres downstream, which ultimately drains into Tuggerah Lake. The highway crosses Cut Rock Creek at two locations in the study area:

- A bridge at Cut Rock Creek north, 500 metres north of Teralba Street.
- A four-cell culvert at Cut Rock Creek south, just north of Ourimbah Street.

The Main Northern Railway Line also crosses Cut Rock Creek adjacent to these locations, with the same type of structures at each crossing. The bridge and culvert crossings over Cut Rock Creek are shown in Figure 3-4.

The existing road and rail culverts at Cut Rock Creek south are of wet cell design. As the culvert inverters are constantly submerged under water, there is no dedicated terrestrial fauna passage.

![Cut Rock Creek north under the existing bridge](image1.png)

![Existing road culverts over Cut Rock Creek south](image2.png)

![Existing railway culverts over Cut Rock Creek south](image3.png)

**Figure 3-3 Existing Cut Rock Creek infrastructure**

The section of Cut Rock Creek between the Pacific Highway culverts and Teralba Street has experienced flooding during major storm events in the past. Council has recently completed extensive improvement works within the creek alignment to reduce flood levels and the extent of inundation through this section of floodplain. The improvements include the installation of levees on the banks of the channel downstream of the existing culverts and upstream of the bridge at Teralba Street. The levees appear to be constructed from a series of sandstone boulders.
covered with soil and vegetation. Large boulders were also placed in the creek bed over a length of around 40m downstream of the culvert outlet. The levees and boulders can be seen in Figure 3-4.

![Existing levees adjacent to Cut Rock Creek](image1)
![Rock boulders and rock levees at Cut Rock Creek](image2)

Figure 3-4  Cut Rock Creek hydrological infrastructure

### 3.2 Design features

#### 3.2.1 Design criteria

The RTA’s design criteria included:

- Two lanes in each direction separated by a median or safety barrier to improve safety for motorists.
- Provision of road shoulder or on-road cycle lanes in both directions.
- A continuous shared use pedestrian/cycleway to improve facilities for pedestrians and cyclists.
- Improved intersections and pedestrian crossing facilities to enhance safety and improve traffic accessibility.
- Indented bus bays to enable buses to stop safely, without interrupting the flow of traffic and to provide safer access for passengers.
- Increased traffic capacity on the Pacific Highway to improve traffic flow and reduce travel times and congestion.
- Provision of at least one flood free lane on both southbound and northbound directions for design flood events up to and including the 100 year average recurrence interval (ARI).

#### 3.2.2 Engineering constraints

The upgrading of this section of the Pacific Highway is constrained on the eastern side of the road by the Main Northern Railway Line and large water pipeline. Where the railway line and pipelines run parallel to the highway, the widening of the road was preferred to be pushed to the western side of the alignment. In addition, Railcorp advised that the Main Northern Railway Line may be amplified to the east or west in the future, which may reduce available space for road widening.

A number of constraints within the local area were identified in developing the concept plan for this proposal. These constraints included:

- The existing Cut Rock Creek crossings, which limited the vertical alignment of the road.
- Commercial properties east of the highway north of Cut Rock Creek bridge.
Lions Park at Ourimbah.
- Lisarow Cemetery.
- Residential properties west of the highway north of Lisarow Cemetery.
- Services including electricity, fibre-optic telecommunication cables, gas, street lighting and sewerage that run along the current road alignment.
- A large diameter water main operated by both Gosford and Wyong Councils located to the east of the current road alignment, from the Cut Rock Creek bridge to Railway Crescent.
- Potential flooding areas associated with Cut Rock Creek.
- Geotechnical conditions which affect slope stability near Cut Rock Creek bridge.
- Four Railcorp access gates into the Main Northern Railway Line along the existing road would need to be maintained, both throughout construction and operation.
- The proposal needs to adequately tie into stage 2 and provide ability for stages 3B and 4 to be designed to tie into it.

3.2.3 Major design features

Key design features associated with the RTA’s concept design include the following:
- Four lane divided carriageway (two lanes in each direction) with median separation (including a median safety fence between Walmsley Road and Glen Road).
- Three signalised intersections with full access in all directions and pedestrian crossings at Ourimbah Street, Teralba Street and Walmsley Road.
- U-turn facility opposite Walmsley Road.
- Off-road shared pedestrian and cycle path that meanders away from the road alignment where possible.
- Road shoulders for an on-road cycleway, vehicle breakdowns and potential police enforcement.
- Upgraded street lighting.
- Six upgraded bus stops with indented bus bays to enable buses to stop safely without interrupting traffic, and provide safer access for passengers.
- The existing bridge crossing would be demolished. Twin parallel single span bridges would be built in its place over Cut Rock Creek (north) for the northbound and southbound road carriageways, with a span length of 30 metres.
- Extension of the existing four-cell culvert over Cut Rock Creek (south) north of Ourimbah Street from 17 metres to 37 metres in length. A median of about two metres is proposed, however this would not be an opening between the culverts.
- Construction of a 200mm high weir at the exit to the Cut Rock Creek culvert extension to balance flows in large events and mitigate potential flooding impacts on existing downstream properties.
- Extension of the existing levees and/or construction of new levees to 22 metres Australian Height Datum on both banks of Cut Rock Creek downstream culvert extension. The levees would be constructed for a length of 35 metres.
- Upgrading of drainage systems that cross two existing vehicular accesses to the railway corridor between the highway and Teralba Street with 900 mm diameter pipe culverts.
- An upgraded residential access road (near Teralba Street), and an upgraded light industrial service road (near Walmsley Road).
One local road roundabout at the intersection of Lisarow Street and Teralba Street.

Landscaping and urban design to enhance the character of the study area.

The proposal is shown in Figure 3-5 to Figure 3-7 below.

3.2.4 Road geometry

Southern limit of works to Cut Rock Creek culvert

The road alignment is constrained by the railway line and large diameter water pipeline to the east, and the cemetery and private properties to the west. Widening would occur largely to the west of the existing carriageway. Key features of the proposed geometry include:

- A horizontal curve with cross fall along the southbound carriageway to limit earthworks and retaining walls and retain RailCorp access gates.
- Either total or partial acquisition of some properties on the western side of the Pacific Highway between the Lisarow Cemetery and Ourimbah Street, to accommodate proposed northbound traffic lanes on the Pacific Highway. Some other properties would require adjustments for services, such as drainage easements to collect stormwater.
- The property to the north west of the intersection in Ourimbah Street would require partial acquisition to accommodate a proposed indented bus bay, a temporary construction sedimentation basin, permanent drainage outlet and swale, and electrical kiosk.
- A vertical alignment which ties into the existing alignment at the southern tie-in.

Cut Rock Creek culvert to Teralba Street

The existing road reserve is relatively wide along this section and does not generally constrain the alignment. The road reserve is bounded by the Main Northern Railway line to the east and residential properties to the west, which either front onto an existing service road or back onto the service road with front access on Lisarow Street. Widening would occur to the west of the existing carriageway. Key features of the proposed geometry include:

- Positioning the southbound carriageway over the existing highway to maximise use of the existing pavement.
- A two way service road from Teralba Street to access properties on the western boundary (similar to existing). A retaining wall is required near the turning head at the southern end of the service road.

Teralba Street to Cut Rock Creek Bridge

The existing road reserve is relatively wide along this section and does not generally constrain the alignment. The road reserve is bounded by the Main Northern Railway to the east and council land and one residential property to the west.

Widening would occur west of the existing carriageway, including at Cut Rock Creek, where bridge duplication would occur to the west. Key features of the proposed geometry include:

- Positioning the southbound carriageway over the existing highway to maximise use of the existing pavement.
- Increasing levels at a low point 200m south of the existing Cut Rock Creek bridge where overtopping can occur on the existing highway, to render the southbound carriageway immune from overtopping in the peak 100 year ARI design rainfall event.
Figure 3-5  The proposal concept plan (1 of 3 figures)
Figure 3-6 The proposal concept plan (2 of 3 figures)
Cut Rock Creek Bridge to Glen Road

The existing road reserve varies in width along this section and is generally not a constraint on the alignment except north of the Walmsley Road intersection. The highway in this section is bounded by light industrial/commercial properties and a service road to the east and a combination of residential properties and businesses to the west. The road reserve area also includes the Lions Park at Ourimbah.

Widening would occur on both sides of the existing carriageway between Cut Rock Creek bridge and Walmsley Road. Between Walmsley Road and Glen Road the widening would be to the west, where an existing service road is located. Key features of the proposed geometry in this section include:

- A road alignment that minimises impact on Lions Park facilities and mature trees, and on the service road on the eastern side of the highway.
- A vertical alignment of the carriageways which minimises disturbance of asphalt containing coal tar, by paving over the top of the existing pavement, which would reduce the quantity of hazardous coal tar waste generated.
- A horizontal and vertical alignment which ties in to the Stage 2 design at the northern extent.
- Modified access to Lions Park to suit the upgraded Walmsley Road intersection. A raised median would be provided on Walmsley Road to prevent unsafe turning movements given the close proximity of the Pacific Highway/Walmsley Road intersection to the park. Access to the park would be left-in/left-out only, requiring a U-turn at Robert Holl Drive to return to the highway.

3.2.5 Intersections

The Walmsley Road intersection would include a ‘4-Way’ junction with traffic signal controls, including full pedestrian access and a new access road and turning facility to the east. The Teralba Street and Ourimbah Street intersections would include ‘T’ junctions with traffic signal controls and full pedestrian access.

3.2.6 Local road intersections

A roundabout is proposed at the intersection of Lisarow Street and Teralba Street, where residential properties on the highway are restricted to left-in/left-out only.

3.2.7 Other road design features

Speed limits

Existing speed limits on the highway would be retained at predominantly 70km/h, with 60km/h at the southern and northern tie-ins to match adjacent speed zones as follows:

- 60km/h from just south of Walmsley Road to match the northern speed zone in Stage 2.
- 60km/h from just south of Ourimbah Street towards the south - the existing posted speed along both the highway (south of Macdonalds Road) and Railway Crescent is 60 km/h.

The posted speed for local roads would be 50km/h.

Access for pedestrians and cyclists

Improvements to the safety and access for pedestrians and cyclists include:

- Three metre wide continuous shared pedestrian/cycle path to the west of the highway.
- Signalised pedestrian crossings at all intersections which allow for safer crossings and access to bus stops on the eastern side of the highway.
• 1.5 metre wide footpaths on the eastern side where required to access bus stops. Bus shelters would be provided by Wyong Shire Council and Gosford City Council when funding is available.
• Road shoulders would be available for on-road cyclists.
• Provision of lighting along the full length of the shared path, including bus shelters and pedestrian crossings.
• Provision of a median safety fence between Walmsley Road and Glen Road, integrated with landscape treatments, to prevent pedestrians crossing the highway away from designated road crossings.

**Lanes**

Travel lanes would be 3.3 metres wide, except where wider lanes are required on curves to meet current design standards. Turning lanes would have a minimum width of three metres.

**Shoulders**

Nearside left shoulders would be provided on each carriageway for break-downs and on-road cyclists. Shoulders would be two metres wide, except in some cases where due to the narrow road reserve the shoulder width would be narrowed to a minimum of 1.8 metres.

**Medians**

Medians would be provided as raised concrete or landscaped medians, or where possible depressed medians with landscaping.

**Verges**

Verges along the highway would vary but typically consist of the following types:
• 1.0 to 1.5 metre verges with rounding for fill embankments with no kerb and gutter.
• Grasped swales immediately adjacent to carriageways (no rounding).
• Six (horizontal) to one (vertical) verge where required for future maintenance access such as for utilities.

**Embankments and earthworks**

Batter slopes of four (horizontal) to one (vertical) in fill are preferred where property constraints allow, and a maximum batter slope of two (horizontal) to one (vertical) is proposed. At the southbound Cut Rock Creek Bridge a one (horizontal) to one (vertical) reinforced soil slope is proposed due to existing ground conditions. Any cut batters would be three (horizontal) to one (vertical) or flatter.

**Drainage and Flooding**

**Drainage**

The final pavement and cross drainage design would be undertaken during detailed design. Where possible the system would be designed to separate cross drainage from pavement drainage to minimise the size of water quality structures where they are required.

Runoff from the highway would be conveyed using a piped drainage system before discharging into gross pollutant traps via swales. Swales would be provided where space permits along the alignment, such as along both sides of the highway between Cut Rock Creek culverts and Teralba Street, between Teralba Street and Cut Rock Creek Bridge and north-east of Cut Rock Creek bridge. This would reduce the amount of kerb and gutter and piped drainage systems.

Gross pollutant traps would be located at low points prior to outlets to existing water courses.
Flooding
Analysis indicates that the major cross drainage elements (the rail/highway culvert system and both the existing and proposed Cut Rock Creek bridges) are capable of conveying flows up to and including the 1 in 100 year ARI event. However, the following flood design measures have been included in the concept design of the proposal to assist in managing potential flooding issues:

- Culvert extension is to be laid at 0.1 per cent grade to assist in the balancing of flows between the eastern and western side of the highway during large events.
- Construction of a 200 mm high weir at the immediate exit to the proposed culvert extension to also assist in the balancing of flows between the eastern and western side of the highway during large rainfall events. A notch would be designed in the weir to allow low flows to pass unimpeded and avoid water ponding inside the culverts.
- Extension of the existing levees and/or construction of new levees to 22 metres Australian Height Datum on both banks of Cut Rock Creek downstream of the highway culvert outlet. The levees would be constructed for 35 metres downstream of the culverts.
- Upgrading of drainage systems that cross two existing vehicular accesses to the railway corridor between the highway and Teralba Street with 900 mm diameter pipe culverts to ensure floodwaters do not flow across the proposed highway.

These measures would be confirmed at the detailed design phase of the project, where the sizing, optimisation and specification of such measures would be finalised. Scour treatment details would also be completed during the detailed design stage, however preliminary estimates are predicted to require about 10 metres of scouring downstream.

Further information regarding flood characteristics and impacts is provided in Section 6.8.

3.2.8 Landscape and urban design
A landscape concept design and urban design framework was prepared to provide principles and guidelines for built elements and landscape treatments. It includes a set of design principles, with measures relating to ecologically sustainable development, water sensitive urban design, ecological restoration and a planting schedule.

The landscape concept design takes into account recommendations from the ecological assessment relating to incorporating threatened species and species representative of endangered ecological communities. Sections along the road alignment showing the landscape concept design are shown in Figure 3-10 to Figure 3-15 below. These sections are indicative of the concept design and may be subject to change during detailed design.

The urban design framework includes design principles for roads, pavements, medians, bridges, earthworks, retaining walls and road furniture.

3.2.9 Pavements
Pavement designs for the proposed upgrade have been carried out in response to the geotechnical conditions and predicted traffic volumes and would be heavy duty, low maintenance pavements, designed for a 40 year life.

Potentially hazardous coal tar material is known to be present within the existing pavement. In order to minimise the disturbance of coal tar, the vertical alignment and pavement design would maximise the use of the existing pavement.

3.2.10 Cut Rock Creek Crossings
Twin parallel single span bridges would be built to replace the existing Cut Rock Creek bridge to allow for the northbound and southbound carriageways, as shown in Figure 3-8. The new
A pedestrian/cycleway would be included in the bridge for the northbound carriageway, on the western side of the highway. As the new bridges are single span, there would be no piers and foundations in the creek bed at this location.

The existing culverts over Cut Rock Creek near Ourimbah Street would be extended to provide for the new northbound carriageway, as shown in Figure 3-9. The culverts would extend 20 metres from the western edge of existing culverts.

The concept design of the bridge at Cut Rock Creek north and the culverts at Cut Rock Creek south meets the principles of Department of Primary Industries (formerly Industry & Investment – Department of Fisheries) requirements for fish passage. Compliance of the design with these requirements would be confirmed at the detailed design stage of the project, where the sizing, optimisation and specification of such measures would be finalised.
Figure 3-10  Landscape cross-sections south of Ourimbah Street

Figure 3-11  Landscape cross-sections north of Ourimbah Street
Figure 3-12  Landscape cross-section between Ourimbah & Teralba Sts

Figure 3-13  Landscape cross-section north of Teralba Street
Figure 3-14  Landscape cross-section at Cut Rock Creek north

Figure 3-15  Landscape cross-section at Lions Park
3.3 Public utilities

Extensive utility services exist throughout the study area. There are a number of utilities which would require relocation as part of the proposal, such as power, water, optic fibre, gas, sewer and low voltage electricity. These utilities are generally located underneath and/or adjacent to the existing road corridor. The utility types, and whether they are likely to be impacted by the proposal, are shown in Table 3-2 below.

Further survey work and pot holing would be undertaken during the detailed design phase. A utility relocation strategy would then be developed and utility relocation designs would be prepared by the utility providers or accredited consulting engineers.

As part of construction, it is likely that adjustments to sewer lines would require works inside private properties.

<table>
<thead>
<tr>
<th>Utility Service</th>
<th>Size/Type</th>
<th>Authority</th>
<th>Impact</th>
<th>Proposed Action</th>
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<td>Water Main</td>
<td>900mm steel cement lined</td>
<td>Wyong City Council</td>
<td>No</td>
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<tr>
<td></td>
<td>100mm asbestos cement, UPVC</td>
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<td>Relocate</td>
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<td></td>
<td>11kV high and low voltage lines</td>
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<td>Underground existing 11kV</td>
</tr>
</tbody>
</table>

3.4 Property acquisition and adjustment

A number of properties would be directly affected by the proposal. Four properties would require total acquisition, which are residential premises on the western side of the Pacific Highway between Lisarow Cemetery and Ourimbah Street. Thirteen properties would require partial acquisition, being residential, vacant or light-industrial land.

Properties to be acquired are listed in Table 3-3, and shown shaded in Figure 3-16 to Figure 3-18 below.
### Table 3-3 Properties to be acquired by the proposal

<table>
<thead>
<tr>
<th>Lot No.</th>
<th>DP</th>
<th>Street Number / Description</th>
<th>Approx. Total Area (m²)</th>
<th>Approx. Acquisition Area (m²)</th>
<th>Approx. % to be acquired</th>
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<td>560299</td>
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<td>603</td>
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<tr>
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<td>964 Pacific Highway, Lisarow</td>
<td>663</td>
<td>663</td>
<td>100%</td>
</tr>
<tr>
<td>24</td>
<td>560016</td>
<td>966 Pacific Highway, Lisarow</td>
<td>713</td>
<td>713</td>
<td>100%</td>
</tr>
<tr>
<td>42</td>
<td>571908</td>
<td>968 Pacific Highway, Lisarow</td>
<td>754</td>
<td>147</td>
<td>20%</td>
</tr>
<tr>
<td>54</td>
<td>576760</td>
<td>970 Pacific Highway, Lisarow</td>
<td>694</td>
<td>169</td>
<td>24%</td>
</tr>
<tr>
<td>53</td>
<td>576760</td>
<td>972 Pacific Highway, Lisarow</td>
<td>718</td>
<td>718</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>553381</td>
<td>974 Pacific Highway, Lisarow</td>
<td>1455</td>
<td>251</td>
<td>17%</td>
</tr>
<tr>
<td>2</td>
<td>811049</td>
<td>978 Pacific Highway, Lisarow</td>
<td>833</td>
<td>80</td>
<td>10%</td>
</tr>
<tr>
<td>3</td>
<td>811049</td>
<td>2 Pacific Highway, Lisarow</td>
<td>832</td>
<td>92</td>
<td>11%</td>
</tr>
<tr>
<td>1</td>
<td>567438</td>
<td>1 Ourimbah Street, Lisarow</td>
<td>2558</td>
<td>724</td>
<td>28%</td>
</tr>
<tr>
<td>4</td>
<td>656509</td>
<td>24 Lisarow Street, Lisarow</td>
<td>1545</td>
<td>249</td>
<td>16%</td>
</tr>
<tr>
<td>5</td>
<td>656508</td>
<td>26 Lisarow Street, Lisarow</td>
<td>1551</td>
<td>211</td>
<td>14%</td>
</tr>
<tr>
<td>6</td>
<td>656507</td>
<td>28 Lisarow Street, Lisarow</td>
<td>1481</td>
<td>96</td>
<td>6%</td>
</tr>
<tr>
<td>8</td>
<td>655114</td>
<td>994 Pacific Highway, Lisarow</td>
<td>1247</td>
<td>24</td>
<td>2%</td>
</tr>
<tr>
<td>104</td>
<td>876413</td>
<td>Wyong Shire Council land, Lisarow</td>
<td>43476</td>
<td>79</td>
<td>0.2%</td>
</tr>
<tr>
<td>C</td>
<td>414879</td>
<td>Light industrial land, Lisarow</td>
<td>8755</td>
<td>2273</td>
<td>26%</td>
</tr>
<tr>
<td>E</td>
<td>414880</td>
<td>Light industrial land, Lisarow</td>
<td>19535</td>
<td>7115</td>
<td>36%</td>
</tr>
</tbody>
</table>

Note: Lot numbers correspond with the Gosford or Wyong Council Rate Payers Lists (March 2009).

Adjacent properties may require adjustment for utilities, and there would be some potential disturbance of private property for access to utilities.

### 3.5 Construction activities

It is currently expected that construction of the proposal would commence in 2013, and take around 18 months to complete.

#### 3.5.1 General activities

The preliminary construction activities for the proposal are outlined below. A construction plan and schedule would be further developed prior to construction after a contractor has been appointed to the works.
Figure 3-16  Proposed property acquisition locations (1 of 3 figures)
Figure 3-17 Proposed property acquisition locations (2 of 3 figures)
Figure 3-18  Proposed property acquisition locations (3 of 3 figures)
• Site establishment and preliminary works - place erosion and sediment controls, introduce traffic management controls, and install other environmental management measures (e.g. architectural treatments) prior to construction.
• Demolish structures that would be removed or upgraded as part of the proposal (excluding the existing bridge crossing Cut Rock Creek, which would only be removed after the new bridge has been built and traffic can be diverted onto it while the existing bridge is demolished).
• Remove vegetation where required.
• Relocate utilities on either side of the highway in stages according to construction phasing.
• Undertake earthworks and drainage works.
• Construct a new bridge and culvert extension on the western side of the existing highway at the two Cut Rock Creek crossings, for the northbound carriageway.
• Construction and modification to the service road, and widening on eastern side of existing highway from 100m north of Cut Rock Creek bridge to the Tall Timbers Hotel.
• Widen the western side of the highway from Teralba Street to 100m north of Cut Rock Creek bridge.
• Switch traffic to new work from Teralba Street to 100m north of Cut Rock Creek bridge.
• Demolish existing bridge over Cut Rock Creek and construct new bridge on existing highway alignment for the southbound carriageway.
• Widen western side of existing highway from Lisarow Cemetery to Teralba Street.
• Construct the new service road between Ourimbah Street and Teralba Street.
• Construct the new roundabout and associated work in Teralba Street.
• Widen the western side of highway from Walmsley Road to Glen Road.
• Switch traffic to new work from Lisarow Cemetery to Teralba Street, and from 100m north of Cut Rock Creek bridge to Glen Road.
• Reconstruct pavement and some overlay to bring existing pavement up to new raised levels for the southbound carriageway.
• Remedial works to existing signals at Glen Road/Pacific Highway intersection.
• Provide signage, line-marking and install traffic control signals.
• Install street lighting and ancillary works including safety fences, pedestrian guardrails and bus lay-by facilities.
• Landscape and rehabilitate disturbed areas.

Construction would generally be between 7am and 6pm Monday to Friday, and Saturday 8am to 1pm.

Some out of hours activities are likely to be required throughout the construction period. These out of hours activities may be due to unforeseen circumstances or be required in order to:
• Undertake works safely and provide protection for workers and members of the public.
• Reduce disruption to traffic and the community.
• Satisfy operational requirements of government agencies or authorities.

Examples of out of hours activities include:
• Works where temporary lane closures along the highway are required to be undertaken out of hours.
• Transitions between phases of traffic control.
• Temporary utility shutdowns during off peak periods for service works and connections into the existing network.
• Delivery to site, and removal from site, of over-sized plant and equipment to conform to RTA requirements.

Measures to reduce noise impacts could include appropriate notification to sensitive receivers, and implementation of additional noise reduction measures. Issues relating to construction noise are addressed in Section 6.2.

3.5.2 Plant and equipment

Plant and equipment required to construct the proposal would typically include:

• Rock hammers
• Excavators
• Cranes
• Graders
• Vibratory rollers
• Water carts
• Haul trucks and heavy transport
• Bitumen spraying plant
• Asphalt paving plant
• Line-marking equipment
• Piling equipment
• Air compressors and generators

3.5.3 Earthworks

It is anticipated that there would be a deficit of spoil from earthworks during construction. This is partly because cut volumes would be lower than fill volumes required, and because some material would be unsuitable for use and would need replacing. Around 28,000m³ of imported fill material would be required, while around 20,000m³ of unsuitable materials would need to be removed from the site.

In addition, the proposal would require around 12,500m³ of selected material for use in the upper sections of the road formation, for which material of a specified higher quality is required. It is anticipated that the selected materials would be imported and would be sourced from a local, licensed supplier where possible.

The RTA is committed to utilising recycled construction materials where possible, which would reduce the impact on natural resources and may provide financial savings. The proposal would seek to utilise recycled materials during construction in accordance with Section 6.12.

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

3.5.4 Traffic management and access

Detailed construction and traffic management and phasing plans would be prepared to ensure that at least one lane is available in each direction at all times during construction. It may be necessary to implement a lower speed of 40km/h on the highway during construction.

Through lanes would be 3.0m wide, and footpaths for pedestrians around work areas would be maintained at all times. Access to private properties would be maintained and temporary bus stops would be implemented.
3.6 Ancillary features

Temporary compounds, stockpile sites and sediment basins would be required during construction. Potential areas for such facilities include:

- Light industrial land on the eastern side of the highway would be suitable for a construction compound, stockpiles and temporary construction sediment basin.
- Wyong Shire Council land near Cut Rock Creek bridge would be suitable for a construction sediment basin.
- Gosford City Council land on the western side of the highway between Ourimbah Street and Teralba Street would be suitable as a stockpile area.
- 980 Pacific Highway on the corner of Ourimbah Street and the Pacific Highway, along with neighbouring residences at 24 and 26 Lisarow Street, to be partly acquired for a construction sediment basin and the permanent northbound carriageway.

These sites would not require additional clearing of native vegetation. Access to these sites would be via service roads where possible, but may be directly onto the highway. Compounds would be established at the commencement of works and operate throughout construction.

If adequate stockpiling capacity cannot be provided using these sites, any spoil that cannot immediately be reused on site would be removed and transported to a licensed disposal facility.

Environmental management measures for the locations described above are included in Section 7.2 of this REF. These measures address potential impacts to nearby residents from noise, and control of erosion and sedimentation.

In the case that the construction contractor locates an alternative stockpiling or construction compound site outside the study area, a separate environmental impact assessment would be required.
4 Statutory and planning framework

4.1 State Environmental Planning Policies (SEPPs)

4.1.1 State Environmental Planning Policy (Infrastructure) 2007

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

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

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

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

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

4.2 Local Environmental Plans (LEPs)

The proposal is within both Wyong and Gosford local government areas (LGAs). The boundary between Wyong and Gosford LGAs is along Teralba Street to the west of the proposal, and along Mannings Road and Cutrock Road to the east of the proposal, as shown in Figure 4-19 and Figure 4-20.

4.2.1 Wyong LEP 1991

The Wyong Local Environmental Plan 1991 sets out the zoning in Wyong Shire and is the local planning instrument that may apply to this proposal. The study area passes through 11 zones as shown in Table 4-4. Zoning areas under the Wyong Local Environmental Plan 1991 are shown below in Figure 4-19.
Figure 4-19  Zoning in Wyong Shire Council section of Stage 3A
(Source: Hyder GIS)
Table 4-4  Wyong Shire Council zoning and permissibility

<table>
<thead>
<tr>
<th>Zone</th>
<th>Without Consent</th>
<th>With Consent</th>
<th>Prohibited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road and road reserve are unzoned</td>
<td>✓</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1(c) Non urban (Constrained Lands)</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>2(a) Residential</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>2(b) Residential (Multiple Dwelling)</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>4(b) Light Industrial</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>5(a) Special Uses</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>5(b) Special Uses (Railways)</td>
<td>-</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td>5(c) Local Roads Reservation</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>7(a) Conservation</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>6(a) Open Space (Recreation)</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>6(c) Open Space (Private Recreation)</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
</tbody>
</table>

4.2.2 Gosford Planning Scheme Ordinance 2008

The Gosford Planning Scheme Ordinance 2008 sets out the zoning in the City of Gosford and is the local planning instrument that may apply to this proposal. The study area passes through eight zones as shown in Table 4-5. Zoning in the area under the Gosford Planning Scheme Ordinance is shown in Figure 4-19.

Table 4-5  Gosford City Council zoning and permissibility

<table>
<thead>
<tr>
<th>Zone</th>
<th>Without Consent</th>
<th>With Consent</th>
<th>Prohibited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road and road reserve are unzoned</td>
<td>✓</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1(c) Non urban</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>2(a) Residential</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>5(a) Special Uses</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>5(b) Special Uses (Railways)</td>
<td>-</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td>5(d) Special Uses (Roads Reservation)</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>6(c) Open Space (Private Recreation)</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
</tbody>
</table>
4.3 Other relevant legislation

4.3.1 Environment Protection & Biodiversity Conservation Act 1999

Under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) a referral is required to the Australian Government for proposed actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. Matters of national environmental significance requiring assessment and approval are:
• Declared World Heritage Properties;
• Declared Ramsar Wetlands;
• Listed threatened species and ecological communities;
• Listed migratory species;
• National Heritage Place;
• Commonwealth marine areas;
• Nuclear actions (including uranium mining); and
• Environmentally significant actions involving Commonwealth land or by Commonwealth agencies.

An assessment of potential impacts of the proposal on matters of national environmental significance is provided in section 6 and Appendix A of this REF. This assessment concluded that the proposal would not result in significant impact on any matters of national environmental significance, and that it would not be necessary to refer the proposal to the Commonwealth Environment Minister.

Section 183 of the Act lists key threatening processes that could affect threatened species, populations of communities. The key threatening process relevant to the proposal is land clearance, which is considered in section 6.1.

4.3.2 Protection of the Environment Operations Act 1997

Activities required to obtain a licence under the NSW Protection of the Environment Operations Act 1997 (POEO Act) are detailed in Schedule 1 to the Act. As the proposal is a main road widening project within a metropolitan area, but is less than three kilometres in distance, Clause 35 of Schedule 1 does not apply.

The Act also permits, but does not require, an Environmental Protection Licence to be issued for a non-scheduled activity for the purposes of regulating water pollution. The construction contractor may therefore decide to obtain an Environment Protection Licence for construction works under Section 43(d) of the Act.

4.3.3 National Parks and Wildlife Act 1974

The National Parks and Wildlife Act 1974 provides the Office of Environment and Heritage the responsibility of establishing and maintaining the Aboriginal Heritage Information Management System (AHIMS). This includes information about known Aboriginal objects or places which have been declared to have special significance with respect to Aboriginal culture.

A permit is required under Section 87 of the Act if excavating, moving or exhibiting any Aboriginal objects, or under Section 90 if knowingly destroying or defacing an object or an Aboriginal place.

As per section 6.6 of this REF, Aboriginal objects or places are not expected to be affected by the proposal, and as such no permits are likely to be required under this Act.

All native birds, reptiles, amphibians and mammals, except the dingo, are protected in NSW by the Act. Under Section 98(2) of the Act, protected fauna cannot be harmed, with certain exceptions. These include ‘an activity by a determining authority within the meaning of Part 5 of that Act if the determining authority has complied with that Part’.

There is potential for the local area to support native species, particularly fauna species. Consideration would be given to avoid or mitigate disturbance and impacts to these species.
4.3.4 Heritage Act 1977

Sections 139 to 145 of the NSW Heritage Act 1977 prevent the disturbance or excavation of any land if there is a reasonable cause to suspect that a ‘relic’ will be discovered, exposed, moved, damaged or destroyed, unless an excavation permit has been issued by the Heritage Council of NSW. The type of permit that is required depends on whether the relic or relics have been listed on the State Heritage Register.

There are no items in the proposal area subject to an Interim Heritage Order, listed on the State Heritage Register, or listed in the RTA’s s170 Heritage and Conservation Register.

As per Section 6.7 of this REF, an archaeological test excavation would be conducted in the area to the south of the last graves within Lisarow Cemetery where proposed works would occur, to determine the presence of unmarked graves. The work would be carried out by a suitably qualified archaeologist under an Exception Permit that would need to be granted by the Office of Environment and Heritage (formerly Heritage Branch, Department of Planning), under section 139(4) of the Act.

Section 148 of the Act requires that the discovery of a previously unknown relic be reported to the Office of Environment and Heritage within a reasonable time of its discovery.

4.3.5 Fisheries Management Act 1994

The NSW Fisheries Management Act 1994 is administered by the Department of Primary Industries (DPI) (formerly Industry & Investment, Fisheries Department), except Part 7, Division 2, which is administered by OEH. The Act requires DPI to be informed about any direct impact on aquatic habitat.

Section 199 of the Act requires written notice to be given to the Minister for Fisheries prior to commencement or approval of dredging or reclamation works. The proposal includes extending the existing culvert on Cut Rock Creek and building a small weir and levees, which is considered as reclamation under the Act. The Minister for Fisheries therefore needs to be notified by the RTA prior to determining the proposal, and the RTA needs to consider any response received within 28 days of the advice.

Section 219 of the Act requires a permit to block or potentially block fish passage. It is unlikely that fish passage would be temporarily blocked during construction of culverts and bridges over Cut Rock Creek. If this cannot be avoided however, a permit would be required from DPI to hinder fish passage prior to commencing works at these locations.

Schedule 6 of the Act lists key threatening processes that could affect threatened species, populations of communities. Key threatening processes relevant to the proposal, and addressed in Section 6.1.3, are:

- The removal of large woody debris from NSW rivers and streams.
- Degradation of native riparian vegetation along NSW water courses.
- Installation and operation of in stream structures and other mechanisms that alter natural flow regimes of rivers and streams.

4.3.6 Threatened Species Conservation Act 1995

The NSW Threatened Species Conservation Act 1995 (TSC Act) lists fauna and flora species, populations and ecological communities that are threatened, and sets a framework within which species, populations and communities are protected. Where a significant impact on threatened species, population or ecological community, or their habitats, may occur due to a development proposal, a ‘Species Impact Statement’ is required.

Section 94 of the Act complements Section 5A (seven-part test) of the EP&A Act, to improve the standard of consideration and protection afforded to threatened species, populations and...
communities, and their habitats in the planning process. The seven-part test sets out factors to consider when determining whether a proposed development has a significant effect on threatened species, populations or ecological communities or their habitats.

Section 6.1 of this REF identifies threatened fauna and flora species, populations and ecological communities in the study area, and assesses impacts to determine whether there are any significant effects.

Schedule 3 of the Act lists key threatening processes that could affect threatened species, populations or communities. Key threatening processes relevant to the proposal, and addressed in Section 6.1, are:

- Clearing of native vegetation.
- Invasion, establishment and spread of Lantana (*Lantana camara*).
- Removal of dead wood and dead trees.
- Loss of hollow-bearing trees.
- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.
- Predation by *Gambusia holbrooki* (plague minnow or mosquito fish).

### 4.3.7 Water Management Act 2000

The NSW *Water Management Act 2000* applies to the proposal as there is a Water Sharing Plan for the Ourimbah Creek Water Source, which includes Cut Rock Creek.

A Controlled Activity Approval under the Act is required for any works carried out on waterfront land. The RTA as a public authority is exempt from the need to obtain a Controlled Activity Approval under the Act, under Section 39A(1) of the Water Management (General) Regulation 2004.

The RTA would investigate the need to obtain permits under the Water Management (General) Regulations for the use of water under section 18(1)(a) and any ‘water extraction works’ under section 90 of the Regulation prior to construction.

### 4.4 Confirmation of statutory position

The proponent and determining authority for the proposal is the RTA. State Environmental Planning Policy (Infrastructure) 2007 provides that the proposal may be carried out without the need for development consent and is therefore subject to assessment under Part 5 of the *Environmental Planning and Assessment Act 1979*. 
5 Stakeholder and community consultation

This chapter discusses the consultation undertaken to date for the proposal and the consultation proposed for the future. The description contains the consultation strategy or approach used and the results of consulting with the community, the Aboriginal community and relevant government agencies and stakeholders.

5.1 Consultation strategy

A community consultation strategy was established in February 2009, which involved:

- Keeping the community and other stakeholders informed about the project in an objective and balanced manner. This would assist stakeholders to understand the planning for the project and the design processes to be followed.
- Consulting with the community and other stakeholders to obtain feedback at the various phases of the design process for the project.
- Involving the community and other stakeholders in developing the options for the upgrade. The strategy includes a range of activities and tools that have ensured that this has occurred, and also would continue to ensure that this occurs.

5.2 Community involvement

The community and stakeholder consultation activities shown in Table 5-6 have been an integral part of the overall proposal since inception. Key activities are described in further detail following Table 5-6. The results of community involvement are described in Section 5.3.

The proposal was initially announced to the community via a media release and the distribution of a ‘Letter to the Householder’, providing background information and inviting residents to the first Community Information Session at Niagara Park on 8 April 2009. This was ‘Phase 1’ of the design stage of the proposal, which involved project investigations.

‘Phase 2’ of the design stage related to design development. Consultation during this phase involved the second Community Information Session at Niagara Park on 29 June 2009 (with both day and evening sessions), shop front displays and the use of feedback forms.

‘Phase 3’ of the design stage related to the preferred design option. Consultation during this phase involved a community update newsletter presenting the preferred option to the community, and inviting viewing and comment on the preferred option.

Property owner meetings – doorknocks

Community doorknocks of residents and local businesses were undertaken in April 2009, primarily targeting properties located directly along the highway. The purpose was to inform these residents and business owners of the project, introduce them to members of the proposal team and receive their feedback. Those that were not at home were left information with the 1800 phone contact details provided.

Community updates/Letter to householders

Around 2000 copies of the Letter to the Householder were letter box dropped or mailed out to residents and stakeholders in the area between Ourimbah and Lisarow in March 2009.

The letter announced the start of the planning process and explained the focus of the first phase of the project. This included providing information on the environmental and engineering studies to be undertaken, the proposed involvement of the community, the community consultation process and details of the community information session on 8 April 2009.
Table 5-6  Community consultation activities undertaken to date

<table>
<thead>
<tr>
<th>Community Consultation Activity</th>
<th>Date</th>
<th>Design stage (see above)</th>
<th>No. participants/respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter to the Householder with ‘Have your Say’ feedback form</td>
<td>March 2009</td>
<td>Phase 1</td>
<td>2000 copies distributed</td>
</tr>
<tr>
<td></td>
<td>August 2010</td>
<td>Phase 3</td>
<td></td>
</tr>
<tr>
<td>Community doorknock</td>
<td>March – April 2009</td>
<td>Phase 1</td>
<td>103</td>
</tr>
<tr>
<td>Community Information Session</td>
<td>8 April 2009</td>
<td>Phase 1</td>
<td>48</td>
</tr>
<tr>
<td>Have your Say feedback form</td>
<td>March – May 2009</td>
<td>Phase 1</td>
<td>100</td>
</tr>
<tr>
<td>Website and advertisements</td>
<td>From March 2009</td>
<td>Throughout</td>
<td>-</td>
</tr>
<tr>
<td>1800 number</td>
<td>Established for the duration of the project</td>
<td>Throughout</td>
<td>35</td>
</tr>
<tr>
<td>Community Information Sessions</td>
<td>29 June 2009</td>
<td>Phase 2</td>
<td>78</td>
</tr>
<tr>
<td>Shop front open days / displays</td>
<td>9 &amp; 11 July 2009</td>
<td>Phase 2</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>September 2010</td>
<td>Phase 3</td>
<td>36</td>
</tr>
<tr>
<td>Feedback forms</td>
<td>June – August 2009</td>
<td>Phase 2</td>
<td>11</td>
</tr>
</tbody>
</table>

The letter provided opportunities for the community to ‘Have your Say’ by returning a short questionnaire. Details were requested on how they wanted to be involved and informed about the design process. There was also a list of questions to gain feedback on concerns, what was valued about their environment and any suggestions and ideas about the proposed upgrade. A second feedback form was made available at the community information sessions in June. In total of 111 responses were received and recorded. Feedback was collated with input from community information sessions and from the 1800 line to provide input into the design process.

A community update newsletter was circulated in the Ourimbah and Lisarow area on 30 August 2010. The newsletter presented the preferred option to the community, and invited comment on the preferred option. The preferred option was displayed from 30 August to 24 September 2010 at the Gosford Motor Registry, Wyong Motor Registry, and the RTA Central Coast office at Woy Woy.

Community Information Sessions

First community information session

At the first community information session on 8 April 2009 at the Niagara Park Community Hall, the community was provided with the background and context of the project, the constraints and opportunities identified at that point in time and given an overview of the consultation process. In the second half of the session, group discussions were held, asking the following questions of the community:

1. What natural features and/or structures and buildings along this section of road do you believe are important to your community?
2. What issues/concerns do you have with upgrading the highway between Lisarow and Ourimbah?
3. What things do you think are important when considering design options?

The outputs of these discussions were made available on the RTA project website. The feedback from this session and from the other feedback received from the ‘Have your Say’ forms, email, door knocks and telephone discussions, was collated and analysed, and was available for the development and assessment of options.
Second community information session

A second community information session was held on 29 June 2009 at the Niagara Park Community Hall. Two sessions were held, one during the day and the other at night, to maximise the opportunity for community members and local business owners to attend.

The session provided a project update and presented the community with a preferred option to widen the highway to the east. The route was divided into three sections – Walmsley Road intersection, Cut Rock Creek to Ourimbah Street and the Railway Crescent intersection. After the short presentation, group discussions were held to allow participants to respond to the following questions for each section. The groups had the opportunity to provide feedback for each section. The questions asked about each section included:

1. How would this arrangement work for you as a motorist, cyclist or pedestrian?
2. What issues have the arrangements not yet considered?

The outputs of these discussions were made available on the RTA project website.

1800 line

A dedicated, toll free information line, 1800 621 676, was set up at the start of the project until May 2010. The phone number was provided in various information publications to the public, with the express aim of facilitating communications between the community and the project team. Around 35 calls were received during its operation.

Website

A project website was established at www.rta.nsw.gov.au/centralcoast for viewing information about the project. The website has been updated with notes from community meetings and additional new information, such as community updates, as the project developed. The website continues to be updated.

Shop front

Shop front open days were held at Niagara Park Shopping Centre on Thursday 9 July 2009 and Saturday 11 July 2009. Project team members were available to answer questions relating to the proposed route option at that time. Any feedback was recorded using ‘Have your Say’ feedback forms.

Individual community meetings

Individual meetings were held with the owners of the small parcel of land bounded by the railway, Pacific Highway and Cut Rock Creek, and with the owners of the light industrial land opposite Walmsley Road and Lions Park.

5.3 Community feedback

Feedback received from the community from the activities described in Section 5.2 was collated and analysed and was used to inform the preferred option.

A separate report, the Lisarow to Ourimbah Community Consultation Issues Report was available on the RTA project website and provided detailed information on feedback received.

5.3.1 Key issues in feedback

Phase 1 – Project investigations

Stakeholders that provided feedback were particularly interested or concerned about intersections on the highway, with management of the Railway Crescent intersection (which was part of the initial scope of ‘Stage 3’ prior to the development of ‘Stage 3A’) being of specific concern.
There were also many comments requesting a solution for pedestrian and cyclist access along the highway. Other concerns related to noise and vibration, and access to arterial roads following the upgrade.

**Phase 2 – Design development**

The majority of stakeholders that provided feedback were particularly interested or concerned about intersections on the highway. There were also many comments in relation to safety in general, and requesting a solution for pedestrian and cyclist access along the highway. Other concerns related to access to property and to arterial roads following the upgrade.

**Phase 3 – Preferred concept design**

The majority of stakeholders that provided feedback were interested or concerned about intersections on the highway, particularly whether they should be signalised. There were also comments in relation to road capacity for the future, retaining Lions Park and street trees, landscaping and native vegetation, parking, bus stop facilities and drainage.

Comments were broadly in support of the proposal, and in particular of the shared path for pedestrians and cyclists.

### 5.3.2 Environmental issues in feedback

Key environmental issues raised by the community, and where these have been addressed in the REF, are shown in Table 5-7.

<table>
<thead>
<tr>
<th>Specific environmental issues identified in community consultation</th>
<th>REF Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retain Lions Park and associated street trees</td>
<td>Section 2.4.3</td>
</tr>
<tr>
<td>Concern over increased operational traffic noise, particularly at intersections</td>
<td>Section 6.2</td>
</tr>
<tr>
<td>Exacerbating existing flooding and drainage issues</td>
<td>Section 6.8.2</td>
</tr>
<tr>
<td>Ensure flood modelling includes impacts on sensitive areas downstream</td>
<td>Section 6.8.2</td>
</tr>
<tr>
<td>New pedestrian footbridges across highway at Ourimbah and Teralba Streets</td>
<td>Section 2.4.3</td>
</tr>
<tr>
<td>Final design should include vegetated median strip</td>
<td>Section 3.2.8</td>
</tr>
<tr>
<td>Concern over loss of vegetation at Cut Rock Creek</td>
<td>Section 6.1.3</td>
</tr>
<tr>
<td>Ensure native vegetation is used for landscaping</td>
<td>Section 6.1.4</td>
</tr>
</tbody>
</table>

### 5.4 Aboriginal community involvement

As part of the preliminary investigations into the proposal consultation with the Darkinjung Local Aboriginal Land Council (LALC) was undertaken. This included:

- Site inspection in January 2008 with Darkinjung LALC Sites Officer Kevin Duncan.
- Preparation of an Aboriginal Heritage Site Report in March 2008 by the Darkinjung LALC detailing site inspection findings.

The results of this consultation were that no heritage or archaeological sites were present, that the Darkinjung LALC had no objection to the proposal, and that a Sites Officer from the Darkinjung LALC should be present on-site during initial excavations for road works.

All previous and future consultation with the Aboriginal community would be undertaken in accordance with the RTA’s Procedure for Aboriginal Cultural Heritage Consultation and Investigations (PACHCI).
The results of the consultation and site inspection are discussed further in the Aboriginal heritage assessment in Section 6.6.

5.5 Government agency and stakeholder involvement

A number of government agencies and stakeholders were consulted during the concept design process in 2009 and 2010. This consultation included:

- Face-to-face meetings with members of the project team.
- Letters (correspondence) to government agencies and stakeholders dated 20 April 2009.
- Joint meetings with DOP, Gosford and Wyong Councils from April 2009 to June 2010, relating to water, sewer and stormwater services, local traffic generation, local heritage items, and flooding.
- Meetings with utility organisations such as the Gosford/Wyong Water Authority in relation to water and sewer in the area.
- Meetings with RailCorp were held in June 2009 to discuss the proposal impacts on the Main Northern Railway Line.

Issues raised through this consultation are outlined in Table 5-8, which also includes a brief response to issues and where they are addressed within this REF. Copies of responses received from government agencies are included in Appendix B.

Clauses 13, 14, 15 and 16 of State Environment Planning Policy (Infrastructure) 2007 (ISEPP) require that public authorities undertake consultation with Councils and other public authorities, when proposing to carry out development without consent.

Formal consultation with Gosford and Wyong councils under clauses 13 and 15 of the ISEPP has been undertaken, and comments were taken into consideration as part of the design process. Any further issues would be considered as part of a submissions reports.

Further consultation with Gosford and Wyong councils would continue throughout the detailed design and construction phases of the project.
<table>
<thead>
<tr>
<th>Government Agency</th>
<th>Issues raised in submission</th>
<th>Response</th>
<th>Where addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW Department of Environment, Climate Change and Water (Sydney and Central Coast)</td>
<td>Proposal is unlikely to require licensing under the POEO Act. RTA should undertake its own environmental investigations to identify relevant issues and adopt appropriate management measures.</td>
<td>Noted</td>
<td>Section 7.3</td>
</tr>
<tr>
<td>NSW Department of Primary Industries – Fisheries (Sydney and Nelson Bay)</td>
<td>Aspects of this proposal of concern to Fisheries include:  - Potential blockage of fish passage through waterway crossings. Any new waterway crossing to be constructed so that it does not obstruct fish passage. Refers to a report concerning waterway crossing design.  - Identification of any in stream works, including creek realignment, and potential erosion and sedimentation impacts on watercourses. The RTA requires concurrence from Fisheries for any proposed dredging and reclamation activities in waterways.</td>
<td>Included in ecological assessment</td>
<td>Section 6.1</td>
</tr>
<tr>
<td>NSW Department of Planning (Sydney and Gosford)</td>
<td>No response received to letter inviting comment.</td>
<td>Fisheries to be notified.</td>
<td>Section 5.6</td>
</tr>
<tr>
<td>NSW Department of Planning, Heritage Branch</td>
<td>Advised that previous heritage approvals in this area include a S139 Exemption from an Excavation Permit in 2006 and a S140 Excavation Permit (2007/8140/013) in 2007. Advised that a non-indigenous heritage assessment should be prepared by a qualified heritage practitioner to identify any items of heritage significance that may be affected by the proposal. The assessment should include:  - A search of heritage registers and statutory instruments to identify known heritage items.  - Field survey of the subject site to identify any additional buildings, works, archaeological relics, potential relics, gardens, landscapes, views, trees or places of non-Aboriginal heritage significance.  - A significance assessment of identified heritage items using criteria for assessing heritage significance published in the NSW Heritage Manual (1996) and Assessing Heritage Significance guidelines.  - An assessment of the impact the proposal would have on the heritage significance of identified heritage items, considering wider heritage impacts in areas surrounding the project.  - Policies and/or measures to conserve the heritage significance of identified heritage items or mitigate the impact on such items. The REF should include an Archaeological Assessment, Methodology and Research Design for any historical archaeological sites that may be affected by the proposal. Further approvals under the 'relics' provisions of the Heritage Act may be required dependent on the results of the archaeological assessment.</td>
<td>Noted</td>
<td>Section 6.7 and Appendix F</td>
</tr>
<tr>
<td>Government Agency</td>
<td>Issues raised in submission</td>
<td>Response</td>
<td>Where addressed</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>HW10 Pacific Highway Lisarow to F3 Stage 3A (Lisarow to Ourimbah) Upgrade</td>
<td>If there is a public notification period, the REF should be provided to DOP. The proposal should have regard to any impacts on places, items or relics of significance to Aboriginal people. For guidelines regarding the assessment of Aboriginal sites, contact the Environmental Protection and Regulation Division of Office of Environment and Heritage (formerly DECCW).</td>
<td>REF to be provided in DOP</td>
<td>Section 5.6</td>
</tr>
<tr>
<td>NSW Office of Water</td>
<td>RTA as a public authority does not require a controlled activity approval. Proposal should however address controlled activity guidelines prepared by NSW Office of Water. A licence is required to extract water from surface or ground water.</td>
<td>Noted, included in ecological assessment</td>
<td>Section 6.1</td>
</tr>
<tr>
<td>NSW Government - Housing NSW</td>
<td>No response received to letter inviting comment.</td>
<td></td>
<td>Section 4.3.7</td>
</tr>
<tr>
<td>Gosford/Wyong Water Authority</td>
<td>Provided a list of technical design issues relating to the potential re-alignment of the 900mm water main.</td>
<td>Included in water main options</td>
<td>Section 3.3</td>
</tr>
<tr>
<td>NSW Mine Subsidence Board – (Sydney and Wyong)</td>
<td>Advised that the area is not within a proclaimed Mine Subsidence District, and therefore not subject to building restrictions imposed by the Board.</td>
<td>Noted</td>
<td></td>
</tr>
<tr>
<td>NSW Department of Education and Training</td>
<td>No response received to letter inviting comment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RailCorp</td>
<td>The Main Northern Railway may in the future be amplified, with one additional track on each side of the existing two tracks.</td>
<td>Included in options assessment</td>
<td>Section 3.2.2</td>
</tr>
<tr>
<td>NSW Rural Fire Service</td>
<td>No concerns or issues.</td>
<td>Noted</td>
<td></td>
</tr>
<tr>
<td>Department of Environment Water Heritage and the Arts (Commonwealth) - DEWHA</td>
<td>No response received to letter inviting comment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW Department of Lands</td>
<td>No response received to letter inviting comment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State Emergency Services</td>
<td>No response received to letter inviting comment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW Police</td>
<td>A 250m sealed enforcement lane should be included between Walmsley Road and Cut Rock Creek north so that Police (and other agencies) can carry out enforcements in safety.</td>
<td>Included in design</td>
<td>Section 3.2.3</td>
</tr>
<tr>
<td>Government Agency</td>
<td>Issues raised in submission</td>
<td>Response</td>
<td>Where addressed</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-----------------</td>
</tr>
</tbody>
</table>
| Gosford City Council   | Transport:  
  - Council proposes to open up Chamberlain Rd to link with Ridgeway Rd and part closure of Macdonalds Rd near the Lisarow primary school. These changes will increase traffic volumes through Chamberlain Rd at Pacific Hwy signals with an increase in through traffic movements.  
  - Address how parallel NS routes such through the University/ Shirley St/Coachwood Dr/Cutrock Rd are to be safeguarded from through traffic movements during construction. | Noted as part of traffic assessment Required as part of Construction Traffic Management Plan | Section 6.4.1  Section 6.4.3 |
|                        | Environment:  
  Address the direct and indirect impacts of the proposed works on the following environmental issues:  
  - Threatened Flora Species - Melaleuca biconvexa  
  - Threatened Fauna Species - Masked Owl, Powerful Owl, Sooty Owl, and other species with known habitat or foraging resources in the locality.  
  - Endangered Ecological Communities - Freshwater Typha Wetland, Coastal Warm Temperate Rainforest  
  - Creek Impacts - gross pollutants, nutrient control, sediment control, stormwater discharge velocities, stormwater discharge volumes  
  - Potential Contamination | Included in ecological assessment Included in soil and water quality assessments | Section 6.1 Sections 6.8 and 6.11 |
| Wyong Shire Council    | No response received to letter inviting comment.                                                                                                                                                                            |                                                                          |                 |

HW10 Pacific Highway Lisarow to F3 Stage 3A (Lisarow to Ourimbah) Upgrade
Page 56  Review of Environmental Factors
5.6 Ongoing and future consultation

This REF is to be placed on public display and community comments will be invited. Details of display dates and locations will be advertised prior to the events.

The REF will be provided to the Heritage Branch of DOP as requested in their submission. I&I Fisheries will be notified of works within Cut Rock Creek as discussed in Section 4.3.5, and consulted during detailed design of creek crossings.

Following display of the REF, a submissions report will be prepared addressing issues raised and made available to the public via the project website.

Consultation and negotiations with individual property owners whose properties would be affected by the preferred option would commence once the REF has been determined.

The community would be informed of any major design changes.

The following ongoing consultation would be undertaken:

- Regular ongoing updates to the surrounding community throughout the remainder of the design phase and the construction phase.
- RailCorp, to manage and minimise any impacts to rail infrastructure during construction and operation of the project.
- NSW Fire Services, to enable up to date emergency response procedures to be complied with during construction and operation.
- Wyong and Gosford councils during the remainder of the design phase and the construction phase, to coordinate consultation with local community and to manage and minimise any impacts to infrastructure.
- Utility organisations, to manage any impacts to utilities during construction and operation of the project.
6 Environmental assessment

This section of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered. This includes consideration of the factors specified in the guideline *Is an EIS required?* (DUAP, 1999) as required under clause 228(1)(b) of the Environmental Planning and Assessment Regulation 2000. The factors specified in clause 228(2) of the Environmental Planning and Assessment Regulation 2000 are also considered in Appendix A. Site-specific safeguards are provided to ameliorate the identified potential impacts.

6.1 Ecology

6.1.1 Methodology

An ecological assessment was completed in June 2010 for stages 3A (the proposal) and 3B of the proposed upgrade between the F3 and Lisarow. The full assessment report is attached as Appendix D to this REF. It was subsequently updated in March 2011. Information from the ecological assessment relating to this proposal (stage 3A) has been extracted, and is summarised below.

The objective of the assessment was to identify potential impacts of the proposal on terrestrial and aquatic flora and fauna species, populations, ecological communities and their habitats. The methodologies used to prepare the assessment are summarised in Table 6-9 below.

The assessment used the following terms:

- **Study region** – the area within 10km of the existing highway. This area was used when identifying the search area on necessary databases.
- **Study area** – land up to 30 metres on either side of the existing highway pavement. This was extended in some areas to incorporate additional adjacent habitat components such as waterways, riparian corridors and patches of remnant vegetation.

**Table 6-9 Summary of methods used for the ecological assessment**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database review for the study region</td>
<td>The Office of Environment and Heritage (formerly DECCW) Wildlife Atlas of NSW, including all native flora and fauna recorded on the database for the 1:100 000 Gosford Map Sheet. This was checked against the Office of Environment and Heritage Threatened Species, Populations and Ecological Communities database, and the Office of Environment and Heritage Biobanking database.</td>
</tr>
<tr>
<td></td>
<td>‘Birdata’ database managed by Birds Australia.</td>
</tr>
<tr>
<td></td>
<td>‘Plantnet’ database managed by the Botanic Gardens Trust.</td>
</tr>
<tr>
<td></td>
<td>The Protected Matters Search Tool managed by the Australian Government Department of Sustainability, Environment, Water, Population and Communities.</td>
</tr>
<tr>
<td></td>
<td>Noxious weed declarations records viewer of fish species by the Department of Industry and Investment.</td>
</tr>
<tr>
<td></td>
<td><em>Fisheries Management Act 1994</em> database search for threatened aquatic species.</td>
</tr>
<tr>
<td></td>
<td>H10 Pacific Highway improvements Lisarow to F3 Stage 1 and Stage 2 Ecological Assessment, Sinclair Knight Mertz, October 2006.</td>
</tr>
</tbody>
</table>
Habitat assessment

A desktop habitat assessment was undertaken for threatened flora and fauna, and migratory species, to determine the probability of occurrence within the study area. The assessment was undertaken using information from Office of Environment and Heritage threatened species profiles, historical information relating to species presence within the study region, and habitat availability.

Field investigations within the study area

Field investigations were undertaken in the study area, and were informed by the results of the database and literature reviews. Field investigations searched for the following ecological components:

- Terrestrial flora – vegetation communities, threatened flora, noxious and environmental weeds.
- Endangered Ecological Communities (EECs).
- Terrestrial fauna – invertebrates, amphibians, reptiles, diurnal birds, nocturnal birds, mammals, bats.
- Habitats.
- Aquatic biodiversity – riparian condition, in-stream condition, aquatic fauna, waterway classification.

Methods used during the field investigations are provided in Appendix D.

6.1.2 Existing environment

The study area is a varied landscape comprising infrastructure and utilities such as roads, power lines, cleared areas, parkland, commercial and residential areas. The residential interface consists of highly modified and disturbed bushland habitats and includes a weedy riparian corridor along Cut Rock Creek.

Past clearing has substantially reduced the extent and condition of native vegetation communities in the road corridor and remaining natural areas. Remnants of vegetation found during field investigations generally exhibited low complexity and floristic diversity. Disturbance and edge effects contribute to a continuing decline in condition. As a result these areas are heavily impacted by weeds. Small elements of regeneration works have been undertaken near Cut Rock Creek bridge, which provides aesthetic and localised ecological benefits.

The larger study region has remnant patches of native bushland in good condition which includes freshwater wetlands and paper bark and eucalypt forests. In addition there are a number of nature reserves and national parks within the study region that provide good corridor movement over the larger region, and good fauna and flora habitat.

Flora

Field investigations recorded a total of 72 native plant species, which are listed in Appendix D.

Twelve threatened flora species were predicted to have the potential occur within the study region based on the database search results. These species are listed in Table 6-10 below. Species that are shaded identify species that were recorded during field investigations. Analysis of habitat found during field investigations and desktop research concluded that the majority of species have a low likelihood of occurring within the study area.
**Table 6-10** Threatened flora species with potential to occur in the study region

<table>
<thead>
<tr>
<th>Common name</th>
<th>Scientific name</th>
<th>EPBC Act status</th>
<th>TSC Act status</th>
<th>Habitat within study area</th>
<th>Significance test applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut-leaf Mint-bush</td>
<td><em>Prostanthera askania</em></td>
<td>E</td>
<td>E1</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Biconvex Paperbark</td>
<td><em>Melaleuca biconvexa</em></td>
<td>V</td>
<td>V</td>
<td>High</td>
<td>Yes</td>
</tr>
<tr>
<td>Magenta Lilly Pilly</td>
<td><em>Syzygium paniculatum</em></td>
<td>V</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Spreading Guinea Flower</td>
<td><em>Hibbertia procumbens</em></td>
<td>-</td>
<td>E1</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Black-eyed Susan</td>
<td><em>Tetratheca juncea</em></td>
<td>V</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>N/A</td>
<td><em>Maundia triglochinoides</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>N/A</td>
<td><em>Epacris purpurascens var.</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Rainforest Cassia</td>
<td><em>Senna acclinis</em></td>
<td>-</td>
<td>E</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Fraser's Screw Fern</td>
<td><em>Lindsaea fraseri</em></td>
<td>-</td>
<td>E</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>N/A</td>
<td><em>Darwinia glaucophylla</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Spider orchid</td>
<td><em>Dendrobium melaleucaphilum</em></td>
<td>-</td>
<td>E</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Camfield's Stringybark</td>
<td><em>Eucalyptus camfieldii</em></td>
<td>V</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
</tbody>
</table>

[V = Vulnerable EPBC Act & TSC Act; E1 = Endangered]

Of these 12 threatened flora species with potential to occur within the study region, only *Melaleuca biconvexa* was identified during field investigations. *Melaleuca biconvexa* is listed as vulnerable under the TSC and EPBC Acts. Around six small independent patches of this species were located within the study, as per Figure 6-21. The five clusters comprise a total of around 20-30 regenerating suckers, two small trees and six medium/tall trees. One larger patch was also identified adjacent to the study area on the opposite side of the railway line.

**Vegetation communities**

Field investigations identified three remnant vegetation communities at locations shown in Figure 6-22. The vegetation communities are listed in Table 6-11, which also lists corresponding endangered ecological communities. No Commonwealth listed endangered ecological communities were detected.

**Table 6-11** Vegetation communities & corresponding EECs identified in the study region

<table>
<thead>
<tr>
<th>Name</th>
<th>Species dominance</th>
<th>Corresponding EEC</th>
<th>Legislative status</th>
<th>EEC approx. extent (ha) – Stage 3A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal Narrabeen Moist Forest</td>
<td><em>Eucalyptus pilularis, E. saligna, Syncarpia glomulifera</em></td>
<td>None</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Coastal Warm Temperate Forest</td>
<td><em>Acmena smithii, Cryptocarya glaucesens, Ceratopetalum apetalum</em></td>
<td>None</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Freshwater Typha Wetland</td>
<td><em>Typha orientalis</em></td>
<td>Sydney Freshwater Wetlands in the Sydney Basin Bioregion</td>
<td>Endangered (TSC Act)</td>
<td>0.3 ha</td>
</tr>
</tbody>
</table>
The Coastal Narrabeen Moist Forest vegetation community was identified as occurring within the study area. This vegetation community is not an endangered ecological community (EEC).

One EEC listed under the TSC Act, *Sydney Freshwater Wetlands (Freshwater Typha wetlands)* was recorded between Robert Holl Drive and the Pacific Highway. This area is a flood zone located at the rear of recent residential development on Robert Holl Drive. The area is regenerating from previous disturbance of agricultural clearing followed by urban development.

The closest SEPP 14 Coastal Wetlands to the study area are located eight kilometres to the south at the confluence of Narara Creek with Brisbane Waters.

**Fauna**

There were 32 native fauna species identified during the field investigation, which are listed in Appendix D. This included five mammal species, 19 bird species, seven reptile species, and one species of frog.

There were 48 threatened terrestrial fauna species predicted to potentially occur within the study region based on the database search results. These species are listed in Table 6-12 below, with shading indicating that the species were recorded during field investigations. The database search identified two specific threatened fauna species as having been recorded within or adjacent to the study area. These were the Masked Owl (*Tyto novaehollandiae*) and Glossy Black-cockatoo (*Calyptorhynchus lathami*). Analysis of habitat concluded that most other species had a low likelihood of occurrence as it is highly disturbed by urban development and there is little suitable habitat or food sources available within the study area.

One listed threatened fauna species was recorded during field investigations, the Eastern Bent-wing Bat (*Miniopteris shrebiersii oceanensis*). This species primarily roosts in caves and is known to use storm water culverts as roost sites. No evidence of this species was detected at the Cut Rock Creek culvert or bridge.

The koala was identified in the above table as having a low likelihood of occurring within the study area. The Koala Habitat Protection State Environmental Planning Policy 44 (SEPP 44) aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas. The SEPP applies to both Wyong and Gosford LGAs. Although the provisions of SEPP 44 do not apply to this proposal it has been considered as part of the assessment.

The proposal area is not considered to contain any core koala habitat or potential koala habitat within the meaning of the policy. A koala food tree identified in the proposal area listed in Schedule 2 of the SEPP is Swamp Mahogany (*Eucalyptus robusta*). The Swamp Mahogany located within the study area does not comprise 15 per cent of the total number of trees in any part of the proposal area. On this basis, further assessment or a koala management plan are not required for the proposal. Further information is provided in Appendix D.
Figure 6-21  Distribution of *Melaleuca biconvexa* adjacent to the proposal

Source: Hyder GIS
Figure 6-22 Vegetation communities identified adjacent to the proposal

Source: Hyder GIS
Table 6-12  Threatened fauna species occurring in the study region

<table>
<thead>
<tr>
<th>Common name</th>
<th>Scientific name</th>
<th>EPBC Act status</th>
<th>TSC Act status</th>
<th>Likelihood in study area</th>
<th>Significance test applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green and Golden Bell Frog</td>
<td><em>Litoria aurea</em></td>
<td>V</td>
<td>E1</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Green-thighed Frog</td>
<td><em>Litoria brevipalmata</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Heath Frog</td>
<td><em>Litoria littlejohni</em></td>
<td>V</td>
<td>-</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Wallum Froglet</td>
<td><em>Crinia tinnula</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Giant Burrowing Frog</td>
<td><em>Heleioporus australiacus</em></td>
<td>V</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Stuttering Frog</td>
<td><em>Mixophyes balbus</em></td>
<td>V</td>
<td>E1</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Giant Barred Frog</td>
<td><em>Mixophyes iteratus</em></td>
<td>E</td>
<td>E1</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Red-crowned Toadlet</td>
<td><em>Pseudophryne australis</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Square-tailed Kite</td>
<td><em>Lophoictinia isura</em></td>
<td>-</td>
<td>V</td>
<td>Medium</td>
<td>Yes</td>
</tr>
<tr>
<td>Osprey</td>
<td><em>Pandion haliaetus</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Black Bitter</td>
<td><em>Ixobrychus flavicollis</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Bush Stone-curlew</td>
<td><em>Burhinus grallarius</em></td>
<td>-</td>
<td>E1</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Gang-gang Cockatoo</td>
<td><em>Callocephalon fimbriatum</em></td>
<td>-</td>
<td>V</td>
<td>Medium</td>
<td>Yes</td>
</tr>
<tr>
<td>Glossy Black-Cockatoo</td>
<td><em>Calyptorhynchus lathamii</em></td>
<td>-</td>
<td>V</td>
<td>Medium</td>
<td>Yes</td>
</tr>
<tr>
<td>Black-necked Stork</td>
<td><em>Ephippiorhynchus asiaticus</em></td>
<td>-</td>
<td>E1</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Wompoo Fruit-Dove</td>
<td><em>Ptilinopus magnificus</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Superb Fruit-Dove</td>
<td><em>Ptilinopus superbus</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Australian Painted Snipe</td>
<td><em>Rostratula australis</em></td>
<td>V</td>
<td>-</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Regent Honeyeater</td>
<td><em>Xanthomyza phrygia</em></td>
<td>E</td>
<td>E1</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Grey-crowned Babbler (eastern subspecies)</td>
<td><em>Pomatostomus temporalis temporalis</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Flesh-footed Shearwater</td>
<td><em>Puffinus carneipes</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Swift Parrot</td>
<td><em>Lathamus discolor</em></td>
<td>E</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Barking Owl</td>
<td><em>Ninox connivens</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Powerful Owl</td>
<td><em>Ninox strenua</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Masked Owl</td>
<td><em>Tyto novaehollandiae</em></td>
<td>-</td>
<td>V</td>
<td>Medium</td>
<td>Yes</td>
</tr>
<tr>
<td>Sooty Owl</td>
<td><em>Tyto tenebricosa</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Eastern Pygmy-possum</td>
<td><em>Cercartetus nanus</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Spotted-tailed Quoll</td>
<td><em>Dasyurus maculatus</em></td>
<td>V</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Yellow-bellied Sheathtail-bat</td>
<td><em>Saccolaimus flaviventris</em></td>
<td>-</td>
<td>V</td>
<td>Medium-high</td>
<td>Yes</td>
</tr>
<tr>
<td>Parma Wallaby</td>
<td><em>Macropus parma</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Eastern Freetail-bat</td>
<td><em>Mormopterus norfoliensis</em></td>
<td>-</td>
<td>V</td>
<td>Medium-high</td>
<td>Yes</td>
</tr>
<tr>
<td>Yellow-bellied Glider</td>
<td><em>Petaurus australis</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Squirrel Glider</td>
<td><em>Petaurus norfoliensis</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
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<tr>
<td>Common name</td>
<td>Scientific name</td>
<td>EPBC Act status</td>
<td>TSC Act status</td>
<td>Likelihood in study area</td>
<td>Significance test applied</td>
</tr>
<tr>
<td>------------------------------</td>
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<td>----------------</td>
<td>--------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Koala</td>
<td><em>Phascolarctos cinereus</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Long-nosed Potoroo</td>
<td><em>Potorous tridactylus</em></td>
<td>V</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Grey-headed Flying-fox</td>
<td><em>Pteropus poliocephalus</em></td>
<td>V</td>
<td>V</td>
<td>Medium-high</td>
<td>Yes</td>
</tr>
<tr>
<td>Eastern False Pipistrelle</td>
<td><em>Falsistrellus tasmaniensis</em></td>
<td>-</td>
<td>V</td>
<td>Medium-high</td>
<td>Yes</td>
</tr>
<tr>
<td>Little Bent-wing Bat</td>
<td><em>Miniopterus australis</em></td>
<td>-</td>
<td>V</td>
<td>Medium-high</td>
<td>Yes</td>
</tr>
<tr>
<td>Eastern Bent-wing Bat</td>
<td><em>Miniopterus orianaee oceanensis</em></td>
<td>-</td>
<td>V</td>
<td>High</td>
<td>Yes</td>
</tr>
<tr>
<td>Large-footed Myotis</td>
<td><em>Myotis adversus</em></td>
<td>-</td>
<td>V</td>
<td>Medium-high</td>
<td>Yes</td>
</tr>
<tr>
<td>Greater Broad-nosed Bat</td>
<td><em>Scoteanax rueppelli</em></td>
<td>-</td>
<td>V</td>
<td>Medium-high</td>
<td>Yes</td>
</tr>
<tr>
<td>Large Pied Bat</td>
<td><em>Chalinolobus dwyeri</em></td>
<td>V</td>
<td>-</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Broad-headed Snake</td>
<td><em>Hoplocephalus bunganoides</em></td>
<td>V</td>
<td>-</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Pale-headed Snake</td>
<td><em>Hoplocephalus bitorquatus</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Rosenberg’s Goanna</td>
<td><em>Varanus rosenbergi</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Varied Sittella</td>
<td><em>Daphoenositta chrysoptera</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>Little Lorikeet</td>
<td><em>Glossopsitta pusilla</em></td>
<td>-</td>
<td>V</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>New Holland Mouse</td>
<td><em>Pseudomys novaehollandiae</em></td>
<td>V</td>
<td>-</td>
<td>Low</td>
<td>No</td>
</tr>
</tbody>
</table>

[V = Vulnerable EPBC Act & TSC Act; E1 = Endangered]

**Habitat**

**Terrestrial habitat**

Field investigations found that native habitat availability for fauna species within the study area is limited. The most complex and least disturbed habitats occur at Lisarow Cemetery near Dora Street where a patch of remnant Coastal Narrabeen Moist Forest occurs with good examples of tall Blackbutt (*E. pilularis*) and Sydney Blue Gum (*E. saligna*). At around one hectare in size this remnant bushland patch is in reasonably good condition and has diverse species composition. It is discontinuous with other nearby similarly sized patches limiting overall fauna habitat value to all but highly mobile species such as microbats and birds. Adjacent residential properties and roads introduce noise and disturbance pressures for most fauna and only species tolerant of these disturbance pressures are likely to persist in this small reserve. Domestic dogs and cats are likely to contribute to fauna decline. No hollow trees were identified during targeted searches undertaken as part of the field investigations.

**Riparian habitat**

Disturbed riparian vegetation along Cut Rock Creek within the study area provides a link between freshwater wetland habitats west of the Pacific Highway and a riparian corridor along Bangalow Creek east of the highway. Further linkages exist between Bangalow Creek and large bushland areas to the west of Tuggerah Lake. This connectivity provides some opportunity for local movement of amphibians, reptiles and mammals, and is likely to be an important means of dispersal for some species between coastal and range habitats.

Vegetation in the riparian zone along Cut Rock Creek was identified as being in poor condition with little presence or continuity of native habitat, and little or no structural complexity of native species. The riparian corridor is dominated by weeds and lacks natural habitat features, such as standing dead trees, woody debris, hollows, fallen logs and leaf litter.
Only one native terrestrial woody species was detected in the riparian zone west of Cut Rock Creek bridge, the Cabbage Tree Palm (*Livistona australis*), which was regenerating along the stream bank. The riparian zone was dominated by woody weed species including Camphor laurel (*Cinnamomum camphora*), Lantana (*Lantana camara*), Broad Leaf Privet (*Ligustrum lucidium*), Small Leaf Privet (*Ligustrum sinense*) and Willow (*Salix sp*). Some weed species provide benefits to aquatic biodiversity by shading the creek, regulating temperature extremes, moderating flows, contributing to build up of debris, and provides structure while stabilising bank conditions.

The riparian condition east of Cut Rock Creek bridge is marginally better with some remnant Coastal Warm Temperate Forest remaining adjacent to the bridge batter and access track. Examples include Lilly Pilly (*Acmena smithii*), Jackwood (*Cryptocarya glaucesens*) and Coachwood (*Ceratopetalum apetalum*). Some trees of these species were removed or slashed in July 2009 for maintenance by utility authorities.

On a microhabitat scale, opportunities exist for some reptiles, frogs and insectivorous bats. Cover is provided at many disturbed sites and weedy re-growth and artificial structures such as bridges and culverts contribute to refuge availability for some species.

**Migratory species**

There were 10 Commonwealth listed migratory birds predicted to occur from the database search within the study region. A habitat analysis was undertaken to determine the probability of occurrence of each species within the study area. The analysis revealed that in most instances habitat components required by the species were absent or, where present, not of suitable condition or structural complexity to support protected species. The Commonwealth listed species, along with the outcomes of the habitat analysis, are listed in Appendix D.

The field investigation identified that habitat components required by these species were absent or, where present, not of suitable condition or structural complexity to support these species.

**Native aquatic fauna**

No threatened species, populations or ecological communities listed under the *Fisheries Management Act 1994* (FM Act) or *Environmental Protection and Biodiversity Conservation Act 1999* were identified from the database search in the study region.

The database search identified that one threatened aquatic species listed as Vulnerable under the TSC Act has the potential to occur within the study area. The Adams Emerald Dragonfly (*Archaeophya adamsi*) has a low likelihood of occurring in the study area, and was not detected during field investigations.

Previous studies undertaken by Newcastle University for the wider area indicated that Platypus may be present in the Cut Rock Creek/Bangalow Creek system to the east of the railway where stream and riparian condition appears to be of better quality. Targeted surveys along Cut Rock Creek during the field investigation did not detect evidence of the platypus and found limited suitable habitat with the study area.

It is considered unlikely that the platypus would occur within the study area.

Four species of native freshwater fish were identified during the field survey at Cut Rock Creek north, which are listed in Appendix D.

**In stream habitat**

Cut Rock Creek is considered a Class 2 waterway according to the classification in Fairfull & Witheridge (2003). A Class 2 waterway is considered to provide moderate fish habitat. Class 2 waterways are typically a named permanent or intermittent stream, creek or waterway with clearly defined bed and banks with semi-permanent to permanent waters in pools or in connected wetland areas. Marine or freshwater aquatic vegetation is present, with known fish habitat and/or fish observed inhabiting the area.
The channel conditions at the Cut Rock Creek bridge comprise sequential pool and riffle sections over substrates that include rocks, gravel, and fine sediments. Water flow at the time of survey was moderate and sufficient to provide adequate oxygenation to sustain a healthy aquatic system. In stream microhabitats were structurally complex and comprised of logs, branches, leaves and living vegetation such as Spotted Knotweed, (Persicaria decipiens), Water Pepper (P. hydropiper) and Broad-leaved Cumbungi (Typha orientalis). Pools and riffles were overhung by woody weed species which provided cover. Log jams were observed upstream of Cut Rock Creek bridge and were evidence of flood events.

The channel condition at Cut Rock Creek culverts at the time of survey comprised pools either side of the highway and a low to nil flow zone through the culverts. Just upstream of the culverts there is a railway crossing also using multi-cell culverts. The substrate consists of fine sediments from stormwater runoff. This volume of water flow is insufficient to provide adequate oxygenation for healthy aquatic systems. In stream microhabitats were structurally simple and vegetation types were similar to those observed at the Cut Rock Creek bridge. However, riparian vegetation was limited and both pools were exposed to full sun.

As the existing in stream habitat is poor at the Cut Rock Creek culvert, and due to existing highway culverts and adjacent railway culverts, fish movements through the creek would currently be limited.

No threatened species habitats (including ‘critical habitat’) listed under the Fisheries Management Act 1994 (FMA Act) were identified in the study area.

**Noxious weeds, exotic species and plant diseases**

Noxious weeds have the potential to cause harm to the community and biodiversity and have the potential to spread to other areas. There are currently 96 noxious weed declarations for Gosford LGA and 94 declarations for Wyong LGA. Noxious weeds are classified 1-5 depending on their threat to primary production or the environment.

A total of 67 exotic plant species were identified during field investigations within the study area (listed in Appendix D), which constitutes 48 per cent of all flora species recorded. Six exotic plant species are noxious - Crofton Weed, Bridal Creeper, Lantana, Blackberry, Willow, Rhus tree. These noxious weed species are listed as class 4, which require preventing plants from flowering or seeding, controlling plants by physical removal or chemical spraying with a registered herbicide, and preventing plants from growing within 10 metres of a property boundary or watercourse.

Four introduced terrestrial fauna species were identified during field investigations, which are listed in Appendix D.

One species of introduced fish, the Plague Minnow (Gambusia holbrooki), was abundant in Cut Rock Creek and was identified near the bridge and culvert. Plague Minnow is listed as a Key Threatening Process (KTP) under Schedule 3 of the TSC Act and Section 183 of the EPBC Act. This issue is addressed further below.

Myrtle Rust is a plant disease that has been recently identified at the Central Coast. It is currently unknown which native Myrtaceae species may be susceptible to Myrtle Rust under Australian conditions, and how severe the impact of the rust may be. Myrtle Rust was not identified during field investigations for the proposal. To date the rust has been found in nursery stock rather than natural areas.

### 6.1.3 Potential impacts

Impacts of the proposal on flora and fauna have been minimised through the development of the proposed alignment. The proposed alignment duplicates the northbound carriageway to the west of the existing Cut Rock Creek bridge, which avoids the need to realign Cut Rock Creek at that location. Easement width is reduced to prevent unnecessary clearing into the freshwater...
wetland EEC and stands of *Melaleuca biconvex*. Where feasible and reasonable the proposal would provide retaining walls instead of batters to retain stands of *Melaleuca biconvexa*.

An assessment of the proposal in relation to key threatening processes identified under NSW (*Threatened Species Conservation Act 1995*, *Fisheries Management Act 1994*) and Commonwealth legislation (*Environment Protection & Biodiversity Conservation Act 1999*) was undertaken, and is included in Appendix D. Relevant findings of this assessment are summarised in the following sections.

An assessment of significance was completed in accordance with Section 94A of the TSC Act and Section 5A of the EP&A Act for the above twelve threatened fauna species likely to occur in the study area.

- Square-tailed Kite.
- Gang-gang Cockatoo.
- Glossy Black Cockatoo.
- Grey-headed Flying-fox.
- Yellow-bellied Sheathtail-bat.
- Eastern Freetail-bat.
- Eastern False Pipistrelle.
- Little Bentwing-bat.
- Eastern Bentwing-bat.
- Large-footed Myotis.
- Masked Owl.
- Greater Broad-nosed Bat.

The impact of the proposal on the Grey-headed Flying-fox was also assessed against ‘significant impact criteria’ under the EPBC Act.

The assessments of significance concluded that the proposal is not likely to significantly impact on the twelve threatened fauna species likely to occur in the study area. Further information is provided in the ecological assessment in Appendix D.

No further assessment is required under the EPBC Act for the Grey-headed Flying-fox.

**Construction**

There is the potential for the following impacts on the ecology of the local environment during construction activities:

- Around one hectare of terrestrial vegetation would be cleared. This would primarily be on the western edge of the highway between Teralba Street and Lions Park. These areas are of low ecological value made up of woody weed species among native trees and shrubs. The proposal is therefore not likely to significantly impact on biodiversity, or fragment habitat.

- Riparian vegetation would be cleared for the bridge demolition and bridge and culvert construction and widening of the crossings. This riparian corridor is primarily vegetated by woody weeds and does not contain native vegetation, with the exception of some regenerating Cabbage Tree Palms (*Livistona australis*) and Green Wattle (*Acacia irrorta*).

- A total of about 240m$^2$ of *Melaleuca biconvexa* (threatened species under TSC Act and EBPC Act) canopy coverage in six independent patches would be heavily disturbed or cleared during construction. An assessment of significance was completed in accordance with the relevant legislation and found that:
The proposal is not likely to significantly impact on the Wyong/Gosford population of *Melaleuca biconvexa* or its habitat, therefore an SIS is not required for this species.

It is unlikely that a referral to the Minister is required under the EPBC Act for *Melaleuca biconvexa*.

No clearing of the adjacent Sydney Freshwater Wetlands EEC west of the Cut Rock Creek bridge would be required. However, there is some potential for indirect impacts to the area from construction. These include reduced water quality and increased potential for edge effects from clearing of adjacent vegetation and opening up the area to general urbanisation impacts.

Clearing of land, especially noxious weeds that are seeding, could encourage the spread of noxious weeds into disturbed areas and creek lines, further spreading the species into the adjacent local environment.

Construction of the culverts would likely require the temporary diversion of the natural creek flows into two of the four culvert cells while construction of the foundation and installation of the pre-cast culvert extension is undertaken. Water flows would then be diverted back into the two extended culvert cells while the process is repeated on the other two culvert cells. This process would limit potential for pollution of the waterways by allowing a dry working area without a major diversion of the creek into a new area. The potential impacts of this would include:

- The natural pools at the downstream exit point of the existing culverts would be removed. These would be cemented over with the slab base for the new extension culverts removing potential existing habitats.
- Increasing natural flows through the reduced number of culvert cells by minimising the area the flows travel through. This could improve fish movement, however, dependent on flows after construction fish may not be able to move back upstream to alternative habitats.
- Excavation of the creek bed where the culverts are to be placed. This would permanently remove an area of natural aquatic habitat within the creek.

Demolition of the existing bridge and construction of the new bridges would likely not involve a diversion of creek flows. There may be some impacts to water quality during the demolition process with concrete dust or bridge structure falling into the creek. The existing pier within the creek would likely be cut off at creek bed level. This may reduce water quality, such as concrete dust or particles, in the creek.

The bridges would be single span bridges and would not require the reconstruction of any piers within the creek line. There may be some impacts during construction of the bridges through the inadvertent dropping of materials into the creek throughout construction.

Construction of the weir, for flood mitigation purposes, would be undertaken in conjunction with the installation of the concrete slab for the culverts utilising the creek diversion to allow for construction in the dry creek area.

The use of construction equipment during construction on the bridges, culverts, weirs and levees could reduce water quality and damage existing riparian and aquatic habitat. These impacts include compaction and or disturbance of the soil, leaks from machinery or equipment or removal/damage of additional vegetation for equipment manoeuvrability in the area to undertake works.

A reduction in water quality or changes to water flows throughout construction may impact aquatic fauna in Cut Rock Creek and other downstream waterways.

Unidentified Myrtle Rust could spread into the local area via contaminated equipment or nursery stock used for landscaping.
Operation

- Fish passage may be affected at Cut Rock Creek culverts during operation of the proposal due to:
  - The extension of the culverts from 17 metres to 37 metres, which is likely to reduce light penetration into the waterway.
  - A small 20 cm weir at the immediate exit to the culvert extension, which would alter flow conditions at that location. The weir would include a notch to allow low flows to pass unimpeded and enable fish passage.
- As the levees would be designed for a 1 in 100 year storm event, it is unlikely that they would impact on normal creek flow, and therefore minimal impact on riparian ecology is anticipated under normal flow conditions.
- There is potential for native fauna mortality from road operations.
- Plague Minnow (*Gambusia holbrooki*) was identified under the Cut Rock Creek bridge during field investigations and is widespread in Cut Rock Creek generally. The proposal is not likely to increase the population densities of *G. holbrooki* in Cut Rock Creek, or exacerbate predation of *G. holbrooki* on native biodiversity.
- Due to its dominance throughout the study area, it is likely that any cleared habitats would be negatively impacted in time by the noxious weed *Lantana camara* and other weeds.

6.1.4 Safeguards and management measures

Flora and fauna controls would be undertaken in accordance with the RTA G40 Clearing and Grubbing specifications, sections 6.9 and 6.10 of the RTA G36 Environment Protection (Management Plan) and the RTA Draft Biodiversity Guidelines - Protecting and Managing Biodiversity During Road Projects and Maintenance (2011). Mitigation measures relating to water quality are outlined in section 6.8 of this report.

Construction

During detail design of the proposal, the following measures would be included in the design:

- *Melaleuca biconvexa* would be incorporated as a key landscape element in suitable habitat locations where practical.
- Impacts to and clearing of *M. biconvexa* would be minimised where feasible and reasonable. The use of retaining walls adjacent to the proposed highway alignment would be considered during detailed design.
- Black Sheoak (*Allocasuarina littoralis*) would be incorporated into the landscaping plans to improve foraging habitat for Gang Gang Cockatoo, Grey-headed Flying-fox and Glossy-black Cockatoo in the local area.
- Investigate the potential for constructing suitable roosting structures for bats at favourable locations adjacent to the proposal.
- Locally endemic species would be used as part of the landscaping plans for the proposal. Exotic species would not be included in the plan.
- The Department of Primary Industries (Fisheries) (formerly NSW Industry and Investment) guidelines ‘Why do fish need to cross the road? – Fish passage requirements for waterway crossings’ would be used when designing all structures within or adjacent to Cut Rock Creek. This would include maintaining fish passage, replicating the natural sandy/gravel stream bed conditions and maximising light penetration within the culverts.
A Construction Environmental Management Plan (CEMP) would be developed prior to construction, and would include a flora and fauna management sub-plan. This plan would include the following measures:

- Clearing of native vegetation would be minimised where feasible and reasonable during construction. Areas not to be cleared would be well delineated by temporary fencing or flagging throughout construction.
- Construction equipment would utilise existing tracks and paths to access each the culvert and bridge construction areas.
- Weed species within the study area would be removed and controlled from spreading where feasible and reasonable.
- Noxious weeds within the proposal area as identified in section 6.1.2 of this REF would be managed in accordance with the *Noxious Weeds Act 1993* and local council control plans.
- *Melaleuca biconvexa* seeds would be collected from local species prior to construction and used for future propagation of the species in the landscaping of the proposal.
- The area of Sydney Freshwater Wetlands EEC between Robert Holl Drive and the Pacific Highway, identified in section 6.1.2, would be identified by a qualified ecologist on site and clearly delineated by temporary fencing or flagging throughout construction to prevent any impacts to the area.
- Clearing of vegetation would be undertaken progressively and inspection of any potential habitat (including nests in shrubbery, trees, holes) would be undertaken prior to clearing.
- The existing Cut Rock Creek bridges and culverts would be inspected by a qualified ecologist for bat species presence prior to demolition and construction. If present a plan to relocate and provide alternative habitats would be developed by a suitable ecologist and agreed to by the regional Environmental Officer.
- A qualified ecologist would check for the potential presence of platypus at the Cut Rock Creek crossings prior to construction at those locations. If detected, further advice would be sought from RTA environment staff prior to any works commencing.
- Qualified ecologists and/or bush regenerators would be used for all regeneration works.
- Fish passage in the creek would be maintained at all times throughout construction of the culverts, bridges, weirs and levees.
- Provisions would be made during demolition and construction of the bridges to minimise sediment or pieces of bridge structure falling into the creek.
- No construction equipment would be placed within the wet creek bed. Equipment may be used on dry creek beds, with appropriate erosion and sediment controls to minimise impacts within and adjacent to the creek, where the waterway has been diverted.
- The Wildlife Information Rescue and Education Service (WIRES) would be contacted if any injured native fauna are found throughout demolition or construction.
- Potential habitat components such as mature trees, fallen logs, loose bark and rocks within the proposal area would be retained and/or relocated and used as landscape features wherever possible within the study area.
- All clearing, bush regeneration and landscaping work would be undertaken in accordance with the (former) NSW Industry and Investment (2010) ‘Guidelines for preventing spread of Myrtle Rust in bushland’.
- All construction workers would undertake inductions to inform them of sensitive ecological areas, potential presence of platypus, and construction methods and safeguards to protect the environment.

**Operation**

- The weir and fish access point would be maintained to provide fish passage at all times.
6.2 Noise and vibration

A noise and vibration assessment of the proposal was conducted by Wilkinson Murray in June 2010, and updated in March 2011. The assessment is contained in Appendix E.

The assessment identified sensitive locations, and studied potential noise and vibration impacts against relevant criteria for both construction and operation of the proposal.

6.2.1 Noise criteria

Construction

NSW Interim Construction Noise Guideline (ICNG) identifies the process to assess construction noise in NSW. These guidelines were developed by the Office of Environment and Heritage (formerly Department of Environment Climate Change and Water) taking into consideration that construction is temporary, noisy and difficult to ameliorate. Consequently the focus is on applying a range of work practices to minimising construction noise impacts, as opposed to achieving a numeric noise level.

For traffic noise assessments the following noise descriptors are used:

- Daytime noise (as LAeq,15hr) from 7.00 am to 10.00 pm.
- Night time noise (as LAeq, 9hr) from 10.00 pm to 7.00 am.

For the assessment of construction noise the Rating Background Level (RBL) is used. The RBL is a conservative measurement of background noise that is used to set noise management levels. There is an RBL value for daytime and night time periods.

The guidelines identify that construction hours should be limited to the following where possible:

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

Additionally, the guidelines recommend quantitative noise management levels at residences as presented in Table 6-13.

For the childcare centre at 2 Robert Holl Drive the residential noise criteria would be adopted.

Table 6-13 Quantitative assessment of construction noise at residences

<table>
<thead>
<tr>
<th>Management Level</th>
<th>How to Apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>L_Aeq (15 min)</td>
<td></td>
</tr>
</tbody>
</table>

Recommended standard hours:
- Monday to Friday 7 am to 6 pm
- Saturday 8 am to 1 pm
- No work on Sundays or public holidays

Noise affected RBL + 10dBA

The noise affected level represents the point above which there may be some community reaction to noise.

Where the predicted or measured $L_{Aeq(15\text{ min})}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise.

The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
### Management Level

<table>
<thead>
<tr>
<th>LAeq (15 min)</th>
<th>How to Apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly noise affected 75dBA</td>
<td>The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outside recommended standard hours</th>
<th>Noise affected</th>
<th>RBL + 5dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dBA above the noise affected level, the proponent should negotiate with the community.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

### Operation noise criteria for residences

Criteria for assessment of road traffic noise are set out in the NSW Government’s Environmental Criteria for Road Traffic Noise (ECRTN). The RTA has also published the Environmental Noise Management Manual (ENMM) to assist in implementing the ECRTN.

Under the ECRTN, road developments are classified as either ‘new road’ or ‘redevelopment of an existing road’. Practice note (i) of the ENMM describes the circumstances under which each of these applies. This proposal would be classified as a ‘redevelopment of existing freeway/arterial road’. The criteria levels set out in Table 6-14 would therefore apply. The criteria in columns 2 and 3 of the table are referred to as ‘base’ criteria. These should be met in all cases, where possible. Criteria in the fourth column of the table are referred to as ‘allowance criteria’.

The ‘existing’ noise levels are described in the ENMM as ‘future existing’ levels – that is, noise levels due to traffic on existing roads as predicted at a time immediately before opening of the project (assumed 2012). In applying Table 6-14, the noise level criterion applies to the predicted noise level at a time 10 years after opening of the project (design year), which in this case is the year 2022.

Table 6-14 **ECRTN criteria for operational traffic noise at residences**

<table>
<thead>
<tr>
<th>Type of Development</th>
<th>Noise Level Criteria</th>
<th>Where Criteria are already Exceeded ('allowance criteria')</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redevelopment of existing freeway / arterial road</td>
<td>LAeq,15hr 60dBA LAeq,9hr 55dBA</td>
<td>In all cases, the redevelopment should be designed so as not to increase existing noise levels by more than 2dB. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In many instances this may be achievable only through long-term strategies.</td>
</tr>
</tbody>
</table>
Where the ‘base’ criteria in Table 6-14 are already exceeded, Practice Note (iv) of the ENMM provides further discussion of situations where provision of additional controls would be considered ‘feasible and reasonable’. In particular, for the ‘redevelopment of existing freeways or arterial roads’ it is generally not considered reasonable to take action to reduce noise levels to the target noise levels if the noise levels with the proposal, ten years after project opening, are predicted to be:

- Within 2dBA of ‘future existing’ noise levels; and
- No more than 2dBA above the target noise levels set out in the Table 6-14.

The RTA’s Environmental Practice Note 24 ‘Noise assessment for acute levels of noise – redevelopment of existing roads’ confirms the following:

‘Application of all feasible and reasonable noise mitigation to aim to achieve the ECRTN noise criteria where, following a road redevelopment:

- There is predicted to be a noticeable increase in road traffic noise, or
- Road traffic noise levels are predicted to be acute.’

**Operational noise criteria for other sensitive receivers**

Within the noise catchment areas defined in section 6.2.3, an additional sensitive noise receiver is a childcare centre at 2 Robert Holl Drive. The centre could potentially be affected by operational traffic noise.

For childcare centres, the Department of Planning and Infrastructure (formerly Department of Planning) guideline ‘Development Near Rail Corridors and Busy Roads - Interim Guideline’ recommends a maximum internal level of LAeq,15hr 40dBA. Assuming that the childcare centre had closed external windows, the equivalent external noise level criterion is estimated at 65dBA LAeq,15hr. There are no specific criteria for external play areas for childcare centres. Typically the criterion for active recreation is used. For active recreation areas the criterion is LAeq,15hr 60dBA.

As above, it is generally not considered reasonable to take action to reduce noise levels to the target noise levels if noise levels, ten years after project opening, are predicted to be within 2dBA of ‘future existing’ noise levels and are no more than 2dBA above target noise levels.

The RTA’s Noise Abatement Program for existing roads prioritises locations where road traffic noise levels are at least 65dBA LAeq,15hr (daytime) or 60dBA LAeq,9hr (night time). These noise levels are termed ‘acute’ noise levels.

### 6.2.2 Relevant Vibration Criteria

Impacts from vibration can affect building occupants (human comfort) and building structures (building damage). As human comfort limits are the most stringent, if compliance with human comfort limits is achieved for occupied buildings, it follows that compliance with the building damage objectives would be achieved.

**Human comfort**

The Office of Environment and Heritage (formerly DECCW) *Assessing Vibration: A Technical Guideline* provides acceptable values for continuous and impulsive vibration in the range 1-80Hz. Both preferred and maximum vibration limits for Peak Particle Velocity (PPV) are defined for various locations and are in Table 6-15.

These limits relate to a long term (15 hours for daytime), continuous exposure to vibration sources. Where vibration is intermittent, a vibration dose is calculated and acceptable values are shown in Table 6-16.
Table 6-15  Preferred/maximum PPV for continuous/impulsive vibration

<table>
<thead>
<tr>
<th>Location</th>
<th>Assessment Period (1)</th>
<th>Preferred Values (mm/s)</th>
<th>Maximum Values (mm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Continuous Vibration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical areas (2)</td>
<td>Day or night time</td>
<td>0.14</td>
<td>0.28</td>
</tr>
<tr>
<td>Residences</td>
<td>Daytime</td>
<td>0.28</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>Night time</td>
<td>0.20</td>
<td>0.40</td>
</tr>
<tr>
<td>Offices, schools, educational institutions and places of worship</td>
<td>Day or night time</td>
<td>0.56</td>
<td>1.1</td>
</tr>
<tr>
<td>Workshops</td>
<td>Day or night time</td>
<td>1.1</td>
<td>2.2</td>
</tr>
<tr>
<td><strong>Impulsive Vibration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical areas (2)</td>
<td>Day or night time</td>
<td>0.14</td>
<td>0.28</td>
</tr>
<tr>
<td>Residences</td>
<td>Daytime</td>
<td>8.6</td>
<td>17.0</td>
</tr>
<tr>
<td></td>
<td>Night time</td>
<td>2.8</td>
<td>5.6</td>
</tr>
<tr>
<td>Offices, schools, educational institutions and places of worship</td>
<td>Day or night time</td>
<td>18.0</td>
<td>36.0</td>
</tr>
<tr>
<td>Workshops</td>
<td>Day or night time</td>
<td>18.0</td>
<td>36.0</td>
</tr>
</tbody>
</table>

Building damage

In regard to potential building damage, German Standard DIN 4150 (Table 1) shows guideline values for short term vibration for commercial buildings, houses and heritage buildings which are dependent on the frequency of vibration. The recommended vibration level for sensitive heritage buildings ranges from 3 to 10mm/s, and 5 to 20mm/s for dwellings.

Table 6-16  Acceptable intermittent vibration dose values (m/s^1.75^

<table>
<thead>
<tr>
<th>Location</th>
<th>Daytime (1)</th>
<th>Night Time (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preferred Value</td>
<td>Maximum Value</td>
</tr>
<tr>
<td>Critical areas (2)</td>
<td>0.10</td>
<td>0.20</td>
</tr>
<tr>
<td>Residences</td>
<td>0.20</td>
<td>0.40</td>
</tr>
<tr>
<td>Offices, schools, educational institutions and places of worship</td>
<td>0.40</td>
<td>0.80</td>
</tr>
<tr>
<td>Workshops</td>
<td>0.80</td>
<td>1.60</td>
</tr>
</tbody>
</table>

Notes:
1) Daytime is 7.00am to 10.00pm and night time is 10.00pm to 7.00am.
2) Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas. Source BS 6472-1992.
6.2.3 Existing environment

Noise monitoring

The assessment identified six catchments along the proposed upgrade route, which are listed below and shown in Figure 6-23. The catchments were arranged by grouping similar receivers on either the east or west of the proposal. For the purposes of the noise assessment these catchment are classified as the study area.

- W1 – west from the highway between Glen Road and Walmsley Road.
- E1 – eastern side of the highway between Glen Road and end of James Graham Lane, between the Pacific Highway and the Main Northern Railway Line.
- W2 – west from the highway from Walmsley Road to the end of Robert Holl Drive.
- W3A – west of the highway between Teralba Street and Ourimbah Street.
- W3B – west of the highway between Ourimbah Street and Railway Crescent.
- E2 – eastern side of the highway.

To assess existing noise levels at residences in the study area, noise was measured at four locations using unattended noise monitoring equipment. Meteorological data from the Bureau of Meteorology for the nearest weather station, located at Gosford about five kilometres south, was obtained and used to exclude noise during periods of rain, or where wind was greater than five metres per second.

Noise monitoring was undertaken at the following locations:

Table 6-17 Noise monitoring locations

<table>
<thead>
<tr>
<th>#</th>
<th>Catchment</th>
<th>Location</th>
<th>Measurement Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1-14</td>
<td>Catchment W1</td>
<td>7 Pacific Highway</td>
<td>31 March to 9 April 2009</td>
</tr>
<tr>
<td>W2-14</td>
<td>Catchment W2</td>
<td>28 Robert Holl Drive</td>
<td>31 March to 9 April 2009</td>
</tr>
<tr>
<td>W3B-3</td>
<td>Catchment W3B</td>
<td>974 Pacific Highway</td>
<td>31 March to 9 April 2009</td>
</tr>
<tr>
<td>E2-4</td>
<td>Catchment E2</td>
<td>35 Baileys Road</td>
<td>15 April to 1 May 2009</td>
</tr>
</tbody>
</table>

$L_{A_{eq}}$ traffic noise

Existing traffic noise at monitoring locations for day and night-time is shown in Table 6-18.

Table 6-18 Measured traffic noise (dBA)

<table>
<thead>
<tr>
<th>#</th>
<th>Location</th>
<th>$L_{A_{eq}}$</th>
<th>$L_{A_{eq},15hr}$</th>
<th>$L_{A_{eq},9hr}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1-14</td>
<td>Catchment W1 - 7 Pacific Highway</td>
<td>66.3</td>
<td>61.7</td>
<td></td>
</tr>
<tr>
<td>W2-14</td>
<td>Catchment W2 - 28 Robert Holl Drive</td>
<td>59.7</td>
<td>54.6</td>
<td></td>
</tr>
<tr>
<td>W3B-3</td>
<td>Catchment W3B - 974 Pacific Highway</td>
<td>66.5</td>
<td>62.0</td>
<td></td>
</tr>
<tr>
<td>E2-4</td>
<td>Catchment E2 - 35 Baileys Road</td>
<td>56.6*</td>
<td>51.5*</td>
<td></td>
</tr>
</tbody>
</table>

Note: * Façade correction of +2.5dB included as measurement was undertaken in an open area.
Figure 6-23  Sensitive receiver catchments (coloured)

Source: Hyder GIS
Background noise levels

Table 6-19 gives the rating background levels measured at each location, which are used as the basis for construction noise assessment.

<table>
<thead>
<tr>
<th>#</th>
<th>Location</th>
<th>Daytime (7am-6pm)</th>
<th>Evening (6pm-10pm)</th>
<th>Night Time (10pm-7am)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1-14</td>
<td>Catchment W1 - 7 Pacific Highway</td>
<td>58.0</td>
<td>53.3</td>
<td>38.5</td>
</tr>
<tr>
<td>W2-14</td>
<td>Catchment W2 - 28 Robert Holl Drive</td>
<td>52.5</td>
<td>47.0</td>
<td>33.3</td>
</tr>
<tr>
<td>W3B-3</td>
<td>Catchment W3 - 974 Pacific Highway</td>
<td>57.3</td>
<td>46.3</td>
<td>32.3</td>
</tr>
<tr>
<td>E2-4</td>
<td>Catchment E2 -35 Baileys Road</td>
<td>44.5</td>
<td>43.4</td>
<td>32.6</td>
</tr>
</tbody>
</table>

The management noise goal for residential receivers for each noise catchment based on the background noise levels measured are presented in Table 6-20.

<table>
<thead>
<tr>
<th>Catchment</th>
<th>Daytime (7am-6pm)</th>
<th>Evening (6pm-10pm)</th>
<th>Night Time (10pm-7am)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>68</td>
<td>58</td>
<td>44</td>
</tr>
<tr>
<td>W2</td>
<td>63</td>
<td>52</td>
<td>38</td>
</tr>
<tr>
<td>W3A &amp; W3B</td>
<td>67</td>
<td>51</td>
<td>37</td>
</tr>
<tr>
<td>E2</td>
<td>55</td>
<td>48</td>
<td>37</td>
</tr>
</tbody>
</table>

Immediately adjacent to the proposal is the Main Northern Railway Line, which contributes to the overall noise levels at sensitive receivers in the area. Noise catchment E1 is located between the existing Pacific Highway and the railway line, however is primarily industrial and has no sensitive receivers. Noise catchment E2 is located on the opposite side, with the railway line between the Pacific Highway and the catchment area. Noise from the railway line is a large contributor to noise levels under both the existing road arrangements and the proposed future road alignment. The potential noise emissions from the railway line have been considered in the assessment to ensure the predicted noise levels only detail emissions from the road.

6.2.4 Potential impacts

Construction noise

Using the assumed plant items and their associated maximum sound power levels (with consideration given to operational changes, intermittent processes and changes in distance of mobile plant), a combined $L_{Aeq}$ sound power levels for each scenario was calculated (Table 6-21). The maximum sound power levels would over-estimate the $L_{Aeq,15min}$ noise level by typically 3dB to 10dB. Based on the above, noise level predictions have been conducted for each of the typical construction events as outlined in Table 6-21.
Table 6-21 Combined Sound Power Level

<table>
<thead>
<tr>
<th>Activity</th>
<th>Typical Equipment Used</th>
<th>Total $L_{Aeq}$ Sound Power Level used for Calculations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site establishment</td>
<td>Excavators, Chainsaws, Mulcher, Chipper, Cranes, Generators</td>
<td>110</td>
</tr>
<tr>
<td>Removal of vegetation</td>
<td>30t Excavator, Mulcher, Chainsaw, Trucks, Grader, Combination Backhoe FEL</td>
<td>111</td>
</tr>
<tr>
<td>Earthworks</td>
<td>Road Trucks, Compactor, Grader, Steel, Multi Tyred and Vibratory Rollers, Concrete Pour, including Trucks and Concrete Vibrator, Asphalt Paving Plant, Backhoe, Sweeper, Compressors, Generators, (Excavator with hammer)</td>
<td>120</td>
</tr>
<tr>
<td>Paving &amp; Milling, bridge demolition and construction and repaving</td>
<td>Road Trucks, Crane, Compactor, (Jackhammers), Steel, Multi Tyred and Vibratory Rollers, Concrete Pour, including Trucks &amp; Concrete Vibrator, Asphalt Paving Plant, Backhoe, (Concrete Saw), Profiler, Sweeper, Compressors, Generators (No blasting would be required for the bridge demolition)</td>
<td>116</td>
</tr>
<tr>
<td>Final Asphalting</td>
<td>Road Trucks, Compactor, Multi Tyred and Vibratory Rollers, Asphalt Paving Plant, Backhoe, (Concrete Saw), Profiler, Sweeper, Compressors, Generators</td>
<td>113</td>
</tr>
<tr>
<td>Concreting</td>
<td>Truck, Crane, Concrete Pump, Power Tools</td>
<td>109</td>
</tr>
<tr>
<td>Piling</td>
<td>Bored Piling or Impact Piling</td>
<td>120</td>
</tr>
</tbody>
</table>

Predicted noise levels at each catchment are given for standard daytime construction hours. For the earthworks and road works the construction is dynamic and noise levels would vary as the location of equipment moves along the study area.

Table 6-22 presents maximum $L_{Aeq}$ levels expected at each catchment without any noise mitigation. Items in bold indicate noise catchments where noise management goals would be exceeded. As noise management goals would be exceeded during construction, noise management and mitigation would be required.

Either impact or bored piling would be required at the two creek crossings, namely at the:

- Culvert near the corner of Ourimbah and the Pacific Highway. The closest residential receiver to this work would be 980 Pacific Highway around 40 metres away.
- Bridge crossing between Walmsley Road and Teralba Road. The closest residential receiver to this work would be 30 Robert Holl Drive around 60 metres away.
Table 6-22 Predicted daytime construction noise levels, $L_{Aeq}$

<table>
<thead>
<tr>
<th>Noise Catchment Area</th>
<th>Daytime Criterion ($dBA$) $L_{Aeq}$</th>
<th>Site Establishment</th>
<th>Vegetation Removal</th>
<th>Earthworks</th>
<th>Paving &amp; Milling and repaving</th>
<th>Final Asphalting</th>
<th>Concreting</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>68</td>
<td>71-76</td>
<td>72-77</td>
<td>75-80</td>
<td>74-79</td>
<td>74-79</td>
<td>70-75</td>
</tr>
<tr>
<td>W2</td>
<td>63</td>
<td>66-68</td>
<td>61-63</td>
<td>70-72</td>
<td>69-71</td>
<td>69-71</td>
<td>65-71</td>
</tr>
<tr>
<td>W3A</td>
<td>67</td>
<td>65-67</td>
<td>60-62</td>
<td>69-71</td>
<td>68-70</td>
<td>68-70</td>
<td>64-70</td>
</tr>
<tr>
<td>W3B</td>
<td>67</td>
<td>72-76</td>
<td>71-75</td>
<td>74-78</td>
<td>73-77</td>
<td>73-77</td>
<td>71-75</td>
</tr>
<tr>
<td>E1</td>
<td>70</td>
<td>71-76</td>
<td>72-77</td>
<td>75-80</td>
<td>74-79</td>
<td>74-79</td>
<td>70-75</td>
</tr>
<tr>
<td>E2</td>
<td>55</td>
<td>62</td>
<td>63</td>
<td>66</td>
<td>65</td>
<td>65</td>
<td>61</td>
</tr>
</tbody>
</table>

Table 6-23 presents maximum $L_{Aeq}$ levels expected at the closest residential receivers due to piling works. From Table 6-23 it is likely that noise management goals would be exceeded from piling. Therefore noise management and mitigation would need to be considered.

Table 6-23 Predicted Noise Levels for Piling Construction, $L_{Aeq}$

<table>
<thead>
<tr>
<th>Closest Residential Receivers</th>
<th>Bored Piling Construction</th>
<th>Impact Piling Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>W2-15 30 Robert Holl Drive</td>
<td>53</td>
<td>71</td>
</tr>
<tr>
<td>W3A-20 980 Pacific Highway</td>
<td>62</td>
<td>80</td>
</tr>
</tbody>
</table>

Construction vibration

Ground vibration may potentially be caused by piling, rock hammering, concrete cutting, drilling and ground compaction associated with road construction. Vibration levels generated during piling, rock hammering, drilling and ground compaction operations would depend on the exact equipment to be used and the type of ground. Table 6-24 provides estimated vibration levels at a range of distances from piling, rock hammering, drilling and ground compaction operations, for typical worst case ground conditions. No blasting would be required for the demolition of the bridge structure.

Table 6-24 Typical vibration emission levels from construction plant

<table>
<thead>
<tr>
<th>Source</th>
<th>Peak Particle Vibration levels, mm/s</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5m</td>
</tr>
<tr>
<td>Vibratory roller</td>
<td>-</td>
</tr>
<tr>
<td>Heavy Rock Breaker</td>
<td>4.5</td>
</tr>
<tr>
<td>Rock drill (estimate)</td>
<td>-</td>
</tr>
<tr>
<td>Light Rock Hammer (e.g. 600kg)</td>
<td>0.2</td>
</tr>
<tr>
<td>Impact Piling</td>
<td>11</td>
</tr>
<tr>
<td>Bored Piling</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: Theoretically there could be an increase in vibration from two pieces of plant operating at the same location and in phase for energy average levels, however this is unlikely to affect the peak particle velocity as they are random incoherent vibration sources. Given this vibration assessments are conducted individual sources.
The vibration criterion associated with building damage to residences is easily complied with, considering typical distances that any construction activities would be occurring from residential buildings. The local heritage building currently operating as the Ourimbah Thai Restaurant is located immediately adjacent to the road alignment. No direct impacts to this heritage item would occur as part of the construction of the proposal (refer section 6.7). The criterion for vibration levels on heritage buildings is 3-10mm/s. All activities at the closest range are predicted to be below this vibration level, therefore there would be a low risk of impacts to the heritage building as a result of construction. The compliance with the criterion indicates that there is a low risk of building damage from the proposed construction works.

Due to the proximity of the construction activities to most catchments, some vibration from construction is likely to be perceptible at the closest residences. Ground compaction with a vibratory roller or impact piling could also be perceptible at the closest residences. In such situations the criteria for human comfort within buildings can be complied with by limiting the duration of the vibration causing activity. This process is described in BS6472:1992 and Office of Environment and Heritage (formerly Department of Environment, Climate Change and Water) Assessing Vibration: A Technical Guideline and would need to be assessed on a site specific basis and would require detailed site specific monitoring.

Operation

Noise levels from both the existing highway and the proposed upgraded highway were modelled using procedures based on the Calculation of Road Traffic Noise (CoRTN, UK Department of Transport, 1988) prediction algorithms, modified for Australian conditions. Traffic data outlined in section 6.4 for current and predicted future traffic levels were utilised in modelling the potential noise levels for the proposal. The scenarios modelled were:

- Year 2012 - before opening.
- Year 2012 - after upgrade completed.
- Year 2022 - 10 years after opening.

Road design information was based on data supplied by the RTA from the concept design, and traffic information was based on data from Hyder Consulting as described in section 6.4.1. The noise models were validated with existing conditions.

The noise modelling indicated that existing noise levels along the highway between Glen Road and Lisarow Cemetery generally exceed noise criteria.

In terms of noise levels from the proposed upgraded highway, noise modelling indicated that:

- Allowance criteria was exceeded at 36 residences in noise catchments W-1, W-2, W-3A and W-3B.
- Acute noise levels are expected at 31 residences in 2022, primarily in noise catchments W-1, W-2, W-3A and W-3B. Noise levels above $L_{A,L,15hr} 60dBA$ (night time) or $L_{A,L,15hr} 65dBA$ (daytime) are considered ‘acute’ and would be considered for noise mitigation, even if traffic noise as a result of the upgrade complies with the allowance criterion.

Table 6-25 shows the residential receivers where the allowance criteria are exceeded and acute impacts are predicted. Modelled noise levels are provided in Appendix E.

<table>
<thead>
<tr>
<th>House</th>
<th>Address</th>
<th>Modelling outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1-2</td>
<td>31 Pacific Hwy</td>
<td>Exceeds acute noise levels</td>
</tr>
<tr>
<td>W1-3</td>
<td>29 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W1-4</td>
<td>27 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W1-5</td>
<td>25 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>House</td>
<td># Address</td>
<td>Modelling outcome</td>
</tr>
<tr>
<td>-------</td>
<td>----------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>W1-6</td>
<td>23 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W1-8</td>
<td>19 Pacific Hwy</td>
<td>Exceeds acute noise levels</td>
</tr>
<tr>
<td>W1-11</td>
<td>13 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W1-12</td>
<td>11 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W1-13</td>
<td>9 Pacific Hwy</td>
<td>Exceeds acute noise levels</td>
</tr>
<tr>
<td>W1-14</td>
<td>7 Pacific Hwy</td>
<td>Exceeds acute noise levels</td>
</tr>
<tr>
<td>W1-15</td>
<td>5 Pacific Hwy</td>
<td>Exceeds acute noise levels</td>
</tr>
<tr>
<td>W1-16</td>
<td>3 Pacific Hwy</td>
<td>Exceeds acute noise levels</td>
</tr>
<tr>
<td>W1-17</td>
<td>1 Pacific Hwy</td>
<td>Exceeds acute noise levels</td>
</tr>
<tr>
<td>W2-13</td>
<td>26 Robert Holl Dr</td>
<td>Exceeds acute noise levels</td>
</tr>
<tr>
<td>W2-14</td>
<td>28 Robert Holl Dr</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W2-15</td>
<td>30 Robert Holl Dr</td>
<td>Exceeds allowance criterion</td>
</tr>
<tr>
<td>W2-16</td>
<td>32 Robert Holl Dr</td>
<td>Exceeds allowance criterion</td>
</tr>
<tr>
<td>W2-17</td>
<td>34 Robert Holl Dr</td>
<td>Exceeds allowance criterion</td>
</tr>
<tr>
<td>W2-18</td>
<td>36 Robert Holl Dr</td>
<td>Exceeds allowance criterion</td>
</tr>
<tr>
<td>W2-19</td>
<td>38 Robert Holl Dr</td>
<td>Exceeds allowance criterion</td>
</tr>
<tr>
<td>W2-24</td>
<td>Lot B 1030 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W3A-1</td>
<td>2 Teralba Street</td>
<td>Exceeds allowance criterion</td>
</tr>
<tr>
<td>W3A-2</td>
<td>Lot 246 Pacific Hwy</td>
<td>Exceeds allowance criterion</td>
</tr>
<tr>
<td>W3A-4</td>
<td>1014 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W3A-6</td>
<td>1010 Pacific Hwy</td>
<td>Exceeds allowance criterion</td>
</tr>
<tr>
<td>W3A-7</td>
<td>1008 Pacific Hwy</td>
<td>Exceeds allowance criterion</td>
</tr>
<tr>
<td>W3A-8</td>
<td>46 Lisarow Street</td>
<td>Exceeds allowance criterion</td>
</tr>
<tr>
<td>W3A-9</td>
<td>44 Lisarow Street</td>
<td>Exceeds allowance criterion</td>
</tr>
<tr>
<td>W3A-10</td>
<td>42 Lisarow Street</td>
<td>Exceeds allowance criterion</td>
</tr>
<tr>
<td>W3A-11</td>
<td>1000 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W3A-12</td>
<td>998 Pacific Hwy</td>
<td>Exceeds allowance criterion</td>
</tr>
<tr>
<td>W3A-13</td>
<td>996 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W3A-14</td>
<td>994 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W3A-15</td>
<td>992 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W3A-16</td>
<td>990 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W3A-20</td>
<td>980 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W3B-2</td>
<td>978 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W3B-3</td>
<td>974 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W3B-4</td>
<td>972 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W3B-5</td>
<td>970 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>House</td>
<td># Address</td>
<td>Modelling outcome</td>
</tr>
<tr>
<td>--------</td>
<td>----------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>W3B-6</td>
<td>968 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W3B-7</td>
<td>966 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W3B-8</td>
<td>964 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
<tr>
<td>W3B-9</td>
<td>962 Pacific Hwy</td>
<td>Exceeds acute noise levels and allowance criterion</td>
</tr>
</tbody>
</table>

Notes:  
1) Acute noise levels are $L_{Aeq,15hr}$ (daytime) or $L_{Aeq,9hr}$ (night time).  
2) Allowance criteria are where existing noise levels exceed base criteria by more than 2dBA.

The noise modelling indicated that maximum noise levels for the current and proposed road alignments at residences may marginally increase by around 2dBA. Research has shown that changes in maximum noise levels of less than 3dBA are generally not perceivable to the human ear (DECCW, 2007). As such it would be unlikely that any increase in maximum noise level would be perceived.

The noise modelling also showed that maximum noise levels would meet ENMM guidelines as any single event $L_{A,\text{max}}$ noise level would be unlikely to exceed the $L_{Aeq,\text{1hour}}$ noise level by more than 15dBA.

### 6.2.5 Safeguards and management measures – Construction

During detailed design of the proposal, feasible and reasonable noise mitigation measures would be examined where noise management levels identified in this REF are exceeded.

A Construction Environmental Management Plan (CEMP) would be developed prior to construction and would include a construction noise and vibration management sub-plan. This plan would include the following measures:

- Establish a publicly available hotline for noise and vibration issues for the proposal.
- Identify a staff member who is the primary contact person responsible for responding to and following-up issues raised by the local community.
- Develop a procedure for how to actively respond to noise and vibration issues.
- Construction activities would be between 7am - 6pm Mondays to Fridays, and 8am - 1pm Saturdays. No works would be undertaken on Sundays or public holidays.
- Should any works be required outside the above standard working hours, such as night works, the procedures in the RTA’s Environmental Noise Management Manual 2001 ‘Practice Note vii – Roadwork’s outside of normal working hours’ would be followed.
- Provide induction training and awareness to construction staff in relation to approved working hours, noise and vibration mitigation measures, minimising equipment noise and switching equipment off when not in use.
- Vibration monitoring would be undertaken at the commencement of vibration-generating activities such as piling or rock hammering, to establish the minimum working distances to nearby vibration sensitive receivers.
- Vibration monitoring would be undertaken when operating a vibratory roller within 30m of a building, to assess compliance with structural or comfort criteria.
- Plant, storage facilities or other ancillary facilities would be located away from sensitive receivers where possible.
- Equipment would be switched off when not in use.
- Construction programming would minimise the use of multiple noise producing equipment at the same time where possible.
All equipment on site would be maintained in a good working order and properly serviced. All vehicles would be fitted with the appropriate mufflers and the use of exhaust breaks would be limited, where possible.

Where feasible and reasonable a combination of any of the following noise mitigation measures would be used to minimise construction noise impacts at adjacent sensitive receivers:

- Temporary noise walls/barriers.
- Respite periods during high noise activities, such as driven piling and rock breaking.
- Use of dampening tips on rock breakers.
- Using spotters, closed circuit television monitors, ‘smart’ reversing alarms, or ‘squawker’ type reversing alarms in place of traditional reversing alarms.
- Selecting plant and equipment based on noise emission levels.

6.2.6 Safeguards and management measures – Operation

Noise mitigation would be implemented for residential receivers where base criteria, allowance criteria and/or acute noise levels are exceeded. This would be determined during detailed design based on the final plans for the proposal. Potential noise safeguards and management measures include:

- Low noise road pavement - noise reduction from using open graded asphalt paving would be less than 2 dBA. However, open graded asphalt has a limited life with respect to wear and noise reduction, therefore may not be practical for this proposal.

- Roadside noise barriers - A noise barrier may be effective at reducing noise levels for residences from 28 to 38 Robert Holl Drive. A feasible and reasonable assessment would be completed during detailed design to determine if this can make up part of the proposal. This barrier would potentially be around 3.5 metres high and run along the back of those properties. If the barrier is not feasible and/or reasonable, other mitigation measures described below would be considered.

- Architectural treatment of exposed residences - architectural treatment of residences would depend on the level of exceedance over the noise criteria. Typically the level of treatment is:
  - 1-10 dBA exceedance - offer fresh air ventilation, sealing of wall vents and check window and door seals and replace where necessary.
  - >10 dBA exceedance - offer fresh air ventilation, sealing of wall vents and check window and door seals and replace where necessary. Offer to upgrade glazing and doors where residences are in a suitable condition and material.

Predicted noise levels in the study area (noise catchments) are all in the first category. Architectural treatment is likely to provide the best method of noise management for this proposal. The use of architectural treatment would be considered in the feasible and reasonable assessment for the proposed noise mitigation of the proposal along with the potential noise barrier outlined above.
6.3 Socio-economic

A review of social and economic impacts was undertaken to understand the separate and cumulative effects of the proposal, and to analyse social values and impacts on community that are likely to occur as a result of the proposal. The assessment looked at the following issues:

- **Property:**
  - Directly affected residential and business properties.
  - Property acquisition.
  - Impacts on community facilities/loss of open space.

- **Traffic and access:**
  - Direct access to and from residential and business properties along the highway.
  - Impact of severance on the community.
  - Access to public transport, community facilities and services in the broader area.
  - Changes to access routes for vehicle users.
  - Access for pedestrians and cyclists.
  - Access to public transport.

- **Local business and economic structures.**

- **Amenity:**
  - Noise and air quality impacts.
  - Visual amenity.
  - Changes in social character and perception.
  - Impacts on residents’ health and stress.

The socio-economic assessment is based on information obtained from:

- A desktop review of available background information, including Australian Bureau of Statistics (ABS) and Wyong and Gosford LGA data.
- The community (residents and businesses) through the consultation process.
- The design development and preferred concept design.

The majority of evaluation is qualitative in nature.

6.3.1 Existing environment

**Background**

The Gosford and Wyong local government areas (LGAs) are located on the Central Coast of NSW, located around 80 kilometres north of Sydney and 80 kilometres south of Newcastle.

Wyong LGA comprises substantial residential areas, with some commercial and industrial land use, and large areas of national parks, state forests, coastline and lakes. The western half of the Shire is predominantly rural. Ourimbah is located in the south of Wyong LGA, on the border with Gosford LGA.

Gosford LGA is predominantly a mixture of rural and residential areas, with some commercial land use. Around 95 per cent of the population live to the east of the F3 Freeway. The LGA covers around 1,030 square kilometres, with large areas of national parks, state forests and nature reserves. Lisarow is located in the north of Gosford LGA, on the border with Wyong LGA.
The suburbs of Ourimbah and Lisarow are characterised by a predominantly semi-rural character, divided by the Northern Railway Line and the Pacific Highway. Properties adjacent to the proposal are described in section 3.1.

Community attitudes and values

No formal survey of community attitudes and values was undertaken for this proposal. However from comments and submissions made through the community consultation process it has been possible to ascertain that parts of the community value:

- Natural surroundings and quiet semi-rural atmosphere of their area.
- The ability to walk and cycle safely throughout their community.
- Lions Park and the large old trees there.
- Convenient access to Gosford, Wyong and the F3 freeway.

Research undertaken for Wyong Shire Council (2008) and Gosford City Council (2001) community plans identified that the community values the ‘country town’ or village feel of the area. They value their location and lifestyle, which is unique and not just a suburb of Sydney.

Looking forward, Gosford City Council’s Community Vision 2025, which involved extensive community consultation, identified the following goals:

- Efficient transportation and infrastructure system which moves people to work and goods to market with minimal congestion.
- Diverse range of travel options including network cycling and walking paths and roads.
- Diverse natural habitats actively managed and enhanced.
- Maintain integrity of open space.
- Holistic approach to safety issues - accessible public spaces and streetscapes.

These attitudes and values were used in this review of environmental factors.

Demographic characteristics

To develop an understanding of communities that may be affected by the proposal, demographic profiling was undertaken using the ABS 2006 Census of Population and Housing and council information. This related to:

- Ourimbah Rural South Social Planning District (‘Ourimbah SPD’).
- Lisarow-Mt Elliot Social Planning District (‘Lisarow SPD’).
- Wyong Local Government Area (‘Wyong LGA’).
- Gosford Local Government Area (‘Gosford LGA’).

Population

The estimated residential population in Wyong LGA was 146,589 in 2008, up by 1.6 per cent from 2007. The population in Gosford LGA was 163,957 in 2008, up by 0.7 per cent from 2007. Between the 2001 and 2006 censuses, the Wyong population grew 5.3 per cent to 137,753, and the Gosford population grew 0.8 per cent to 155,956. This suggests that population growth is slowing in both LGAs.

In 2006 Ourimbah SPD had a population of 4,330 in 2006, representing 3.1 per cent of the Wyong LGA. The population grew by 3.3 per cent between 2001 and 2006, lower than the LGA growth rate of 5.3 per cent. Lisarow SPD had a population of 5000, representing 3.2 per cent of the Gosford LGA. The Lisarow population grew 9.3 per cent between 2001 and 2006, higher than the LGA growth rate of 0.8 per cent.
The central coast region has seen substantial population growth in recent years compared to the NSW average, particularly amongst families with young children and older persons. Lisarow and Ourimbah have a much higher proportion of very young (aged 0-4) and young (aged 5-17) people compared to both the LGAs and NSW. There are significantly less residents aged 65 and over in both suburbs in comparison with the LGAs.

The following table summarises the key population and dwelling forecasts for the years 2006 (baseline) 2016 and 2031.

### Table 6-27 Population projections – Ourimbah SPD and Wyong LGA

<table>
<thead>
<tr>
<th></th>
<th>Ourimbah SPD</th>
<th>Wyong LGA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Est. population</td>
<td>4,434</td>
<td>4,393</td>
</tr>
<tr>
<td>Households</td>
<td>1,553</td>
<td>1,644</td>
</tr>
<tr>
<td>Dwellings</td>
<td>1,629</td>
<td>1,745</td>
</tr>
<tr>
<td>Average household size</td>
<td>2.84</td>
<td>2.63</td>
</tr>
</tbody>
</table>


### Table 6-28 Population projections – Lisarow SPD and Gosford LGA

<table>
<thead>
<tr>
<th></th>
<th>Lisarow SPD</th>
<th>Gosford LGA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Est. population</td>
<td>4,830</td>
<td>4,941</td>
</tr>
<tr>
<td>Households</td>
<td>1,572</td>
<td>1,762</td>
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<tr>
<td>Dwellings</td>
<td>1,591</td>
<td>1,783</td>
</tr>
<tr>
<td>Average household size</td>
<td>3.01</td>
<td>2.75</td>
</tr>
</tbody>
</table>

Source: Gosford City Council forecast id (2009) (Usual residence data)

Whilst populations in Lisarow and Ourimbah are not projected to change significantly in the next 10 years, a substantial increase in households and dwellings is expected. The projected growth in both LGAs would have an effect on the number of users on the road network.

### Household structure

Three quarters of households in Ourimbah SPD comprise family households, with a further 20 per cent comprising lone person households (70 and 25 per cent respectively in Wyong LGA. Half of all families comprise couples with children, with an additional 17 per cent comprising one parent families (41 and 20 per cent respectively in the Wyong LGA).
Eighty five per cent of households in Lisarow SPD comprise family households compared to 67 per cent in the Gosford LGA. Only 11 per cent of households in Lisarow comprise lone person households (25 per cent in the Gosford LGA). More than half (60 per cent) of all families in Lisarow SPD are couple families with children (45 per cent in the Gosford LGA) with one parent families comprising 13 per cent (18 per cent in the Gosford LGA).

**Vehicle Ownership**

Only four per cent of households in Ourimbah SPD did not own a vehicle compared to 10 per cent in Wyong LGA. Over one third (35 per cent) owned one vehicle and over half (55.6 per cent) owned two or more vehicles, compared to 40 and 43 per cent respectively in the Wyong LGA. In Lisarow SPD, 2.7 per cent of households did not own a vehicle compared to 11 per cent in Gosford LGA. Just under one third (31 per cent) owned one vehicle and close to two thirds (62 per cent) of all households owned two or more vehicles, compared to 38 and 42 per cent in Gosford LGA respectively.

Journey to work data is calculated at the LGA level, and in both Wyong and Gosford LGAs the predominant form of travel was cars as drivers (65, 64 per cent respectively), followed by cars as passengers (6.5 and 6 per cent respectively).

**Need for Assistance**

The 2006 census calculated populations in ‘need of assistance’, which is defined as people needing help or assistance due to a long-term health condition or disability (lasting six months or more), or old age. Ourimbah had 2.3 per cent of residents with a need for assistance, compared to 5.5 per cent in the Wyong LGA. Whilst the need for assistance within the Lisarow/Ourimbah area is currently relatively low, it does require consideration.

**Table 6-29 Need for assistance**

<table>
<thead>
<tr>
<th>Locality</th>
<th>Ourimbah (suburb)</th>
<th>Wyong LGA</th>
<th>Lisarow (suburb)</th>
<th>Gosford LGA</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>72</td>
<td>7,713</td>
<td>188</td>
<td>7,056</td>
</tr>
<tr>
<td>Percentage</td>
<td>2.3%</td>
<td>5.5%</td>
<td>3.6%</td>
<td>4.5%</td>
</tr>
</tbody>
</table>

*Source: ABS 2006 Census of Population and Housing, BCP Table (enumerated data)*

**Socio-Economic Indexes**

The SEIFA indexes (Socio-Economic Index for Areas) by the Australian Bureau of Statistics provides a relative measure of socio-economic advantage and disadvantage, where the NSW average is 1,000. The table below shows the results in the suburbs of Ourimbah and Lisarow as well as at the LGA level, from the 2006 census. Higher scores indicate a greater advantage in general, showing that there are relatively more households with high incomes or people in skilled occupations.

The table also shows the relative index of household economic resources in each area. Higher scores reflect greater economic resources, suggesting higher household incomes and home ownership.

**Table 6-30 SEIFA index levels**

<table>
<thead>
<tr>
<th>Locality</th>
<th>Advantage/Disadvantage</th>
<th>Economic Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>All NSW</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Ourimbah</td>
<td>1023</td>
<td>1015</td>
</tr>
<tr>
<td>Lisarow</td>
<td>1070</td>
<td>1085</td>
</tr>
<tr>
<td>Gosford LGA</td>
<td>1013</td>
<td>1008</td>
</tr>
<tr>
<td>Wyong LGA</td>
<td>955</td>
<td>977</td>
</tr>
</tbody>
</table>

*Source: ABS SEIFA, 2006.*
Accessibility

The Pacific Highway provides the main access route in the region, connecting Gosford and the F3 Freeway. It serves as the primary access route for local residents and business users. There are 43 residences and eight businesses that have direct access onto the highway, and some use informal service roads adjacent to the highway.

Ourimbah railway station is located on the highway, and local bus routes use the highway.

Community concerns raised during the consultation process included the current lack of safe pedestrian and cycle access both along and across the highway. No safe crossing facilities (such as a signalised intersection) currently exist to traverse the highway from east to west, to access bus stops, commercial properties or the Baileys Road pedestrian bridge over the railway.

The community was also concerned about long waiting times to turn at some intersections.

The only community facility located adjacent to the proposal is Lions Park, which is a popular park with families and commuters alike. A privately owned childcare centre is located on the corner of Robert Holl Drive and Walmsley Road.

Access to Lisarow Cemetery is via Lisarow Street, off Ourimbah Street.

Around one kilometre north of the study area is the Ourimbah education precinct, and a number of key community facilities. These facilities can be accessed using the Pacific Highway via Chittaway Road, from the east via Brush Road, or from the south via Shirley Street. Facilities and institutions in this area include:

- Hunter Institute of Technology (TAFE).
- University of Newcastle Central Coast Campus.
- Ourimbah rugby and soccer grounds.
- Ourimbah Public School.
- Ourimbah Community Centre.
- Ourimbah-Lisarow RSL.
- Bill Sohier Park and tennis courts.
- Tall Timbers Pony Club.

To the south of the study area lie the following community facilities:

- Pluim Park and playing fields.
- Lisarow Public School, Lisarow High School.
- Lisarow Plaza Shopping Centre.
- Niagara Park Shopping Centre, Community Centre, Youth Centre, Library.
- Niagara Park Primary School.
- Narara Primary School.

One of the objectives for the highway upgrade is to ‘improve accessibility for all road user groups including motorists, pedestrians, cyclists, public transport and road freight operators’ (refer section 2.2). The proposal would improve accessibility to these community facilities for residents in the local areas.

The efficiency of the road network is therefore of major social and economic significance to the local community and the wider region.
Local business

Local businesses adjacent to the proposal are primarily located in the north at Ourimbah, extending from opposite Lions Park to Glen Road.

Commercial businesses include Ourimbah Thai and the Tall Timbers Hotel on the western side of the highway. These businesses are accessed via a service road on the western side of the highway, running adjacent to the highway. There is some informal parking at the Tall Timbers Hotel end of this access road for local businesses. The Tall Timbers Hotel has a separate car park area available for its customers.

There is also a small light industrial area between the highway and the railway on the eastern side of the highway opposite Walmsley Road, comprising a service station, veterinary hospital, landscape suppliers and modular building suppliers. These businesses are accessed via a service road on the eastern side of the highway, running adjacent to the highway. Entry to the service road is from the north of Walmsley Road, with the exit south of Walmsley Road. There is currently no connection between the service road and the Walmsley Road intersection.

There is a commercial shop on Ourimbah Street near the corner with the highway.

Amenity and land use

The current land use in the local area is a mixture of residential, largely to the western side of the highway, with pockets of bushland and scattered businesses at the northern end of the proposal. This provides a semi-rural amenity for residents of the area.

The existing road is a two-lane (one lane in each direction) road with no formal guttering and dirt shoulders in sections which contributes to the feel of a semi-rural atmosphere. However, increasing traffic flows along the highway in recent years has contributed to corresponding increases in noise and air quality impacts along the route.

Feedback received from residents during the consultation process has shown that they value the natural environment and wildlife in their area. In terms of the proposal, they are concerned about increased noise, loss of privacy, and visual impact of noise barriers if they were to be installed.

6.3.2 Potential impacts

Construction

Property

As discussed in section 3.4, four residential properties would be affected by complete acquisition of land for the proposal, and 13 other properties would be partly acquired.

There would be property acquisition of light industrial land on the eastern side of the highway opposite Walmsley Road, due to service road realignment and construction of a u-turn facility.

The following properties would be impacted by temporary works during construction, subject to confirmation prior to construction:

- Light industrial land (to east of the highway, opposite Walmsley Road) for construction compound, stockpiles and sediment basin.
- Wyong Shire Council land (near Cut Rock Creek Bridge) for a sediment basin.
- Gosford City Council land in the residential service road south from Teralba Street for a stockpile area.
- 980 Pacific Highway (corner of Ourimbah Street and Pacific Highway) to be partly acquired for the northbound carriageway.

Some properties may also be temporarily affected by disruptions to utilities such as water, gas, phone and power as some relocation of services would be required as part of the proposal.
Traffic and Accessibility

Access to some properties, including businesses, along the highway would be impacted during construction, however the RTA has a commitment to maintain reasonable access to all properties. Access to adjacent properties for pedestrians would be maintained throughout construction. There may be some impacts to pedestrians and/or cyclists during construction where detours are required around the construction site to ensure public safety.

Access to the Lions Park and Lisarow Cemetery may be impacted during construction. All informal parking adjacent to the highway would be prohibited.

Local business

The construction of the proposal would provide positive temporary economic benefits by providing employment opportunities and business for suppliers in the local region.

There would be some delays to traffic during the construction phase, which may have flow on effects of reducing convenience and increasing travel times. Access to all business operations and properties would be maintained during construction.

During construction no on-road parking would be permitted along the upgraded section of the Pacific Highway. In addition, the existing informal parking along the access road on the western side of the highway in front of the commercial businesses would be removed.

Amenity and land use

The overall amenity of the area would be impacted by increases in construction traffic, traffic delays, dust and noise associated with construction. Details of specialist studies relating to these issues are in sections 6.4, 6.9 and 6.2 respectively.

The air quality assessment in section 6.9 found that there would be some dust impacts during the construction phase, although these would likely be temporary and localised. Noise impacts may at times exceed the relevant noise criteria.

The establishment of a new roundabout at the intersection of Lisarow Street and Teralba Street would have a minor impact on several properties due to additional traffic and construction noise.

Operation

Property

The proposed upgrade includes road widening and would have an impact on some residential and business properties along the highway, predominantly property adjustments to driveways.

Traffic and Accessibility

Accessibility changes along the length of the proposal include:

- Raised median would prohibit right-hand turns across opposing traffic lanes into and out of driveways.
- Shared pedestrian and cycle off-road path on western side which would provide improved accessibility for all pedestrians and cyclists.
- Widened nearside shoulder to accommodate cyclists which would provide improved accessibility and safety for cyclists.
- Signalised intersections at Ourimbah Street, Teralba Street and Walmsley Road, with signalised pedestrian crossings to provide safer crossing for pedestrians and cyclists.
- Service road at Teralba Street – right turning movements out prohibited by raised median.
- A roundabout at the intersection of Teralba Street with Lisarow Street to provide improved accessibility for turning, away from the main traffic flow.
- Improved bus stops with concrete footpaths connecting to nearest intersection.
The proposal would reduce traffic waiting times and delays at intersections, and thereby improve accessibility within and around the area. Further details are provided in Section 6.4.

Table 6-31 summarises changes to existing vehicle access arrangements. All proposed modified access arrangements are considered to have only a minor impact on travel times which would be offset by improved safety for turning vehicles.

Table 6-31 Modified Vehicle Access Arrangements

<table>
<thead>
<tr>
<th>Existing access arrangement</th>
<th>Modified entry into properties</th>
<th>Modified exit from properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Properties between Lisarow Cemetery and Teralba Street with direct access to the highway. Current all turning movements are permitted.</td>
<td>Left turn in only. Vehciles wanting to turn right would continue south about 1.6 km to the roundabout to perform a U-turn and continue north along Pacific Highway to turn left into properties.</td>
<td>Left turn out only. Vehicles wanting to turn right would turn left and use new roundabout at Lisarow Street, then turn right onto highway at new signalised intersection.</td>
</tr>
<tr>
<td>Service road along western side of highway, south of Teralba Street. Currently all turning movements are permitted.</td>
<td>Left turn in only for light vehicles. Heavy vehicles would turn at Walmsley Road and return to turn right into Teralba Street, and left into the service road. Right turn would be permitted at Teralba Street at new signalised intersection, and left into the service road.</td>
<td>Left turn out only. Vehicles wanting to turn right out of the service road would turn left and use new roundabout at Lisarow Street and turn onto the highway at new signalised intersection.</td>
</tr>
<tr>
<td>Access to the northern part of the light industrial area near Walmsley Road, currently accessed from a service road.</td>
<td>Left-in from the highway at existing entry permitted. Right turn in would be prohibited. Vehciles wanting to turn right would use the roundabout at Glen Road or Chittaway Road.</td>
<td>Left and right turn out onto the highway via the signalised intersection at Walmsley Road. Access to the signalised intersection via one-way service road and turning head.</td>
</tr>
<tr>
<td>Access to the southern part of the light industrial area near Walmsley Road, currently accessed from a service road.</td>
<td>Left and right turn-in from the highway at signalised intersection at Walmsley Road permitted.</td>
<td>Left out onto the highway at the southern end of the one-way service road. Right turn out would be prohibited requiring a right turn into Teralba Street to use the new roundabout. Heavy vehicles would be required to travel south along the Pacific Highway about 1.6 km to U turn at the roundabout outside the Lisarow Plaza Shopping Centre.</td>
</tr>
</tbody>
</table>

The continuous shared path for pedestrians and cyclists (which would also be accessible for mobility impaired people) with signalised crossings at all intersections would provide a positive enhancement for accessibility in the area.

**Local business**

The proposal would address current and predicted future congestion and safety issues. It would also improve access to commercial and light industrial premises by providing shorter travel times and increased safe turning movements.

Operation of the upgraded road would provide positive economic impacts for the local area and region, both on its own and cumulatively with other adjacent road upgrades along the Pacific Highway in the Central Coast. By improving this section of the highway, a reduction in the
number of accidents and a reduction in travel time along the highway would be expected, in addition to improved access and safety for both drivers and pedestrians. Improved access and travel times would also assist freight vehicles in accessing the local businesses and travelling through this area.

The existing access road on the western side of the highway, in front of the Tall Timbers Hotel and Ourimbah Thai would be removed and replaced by the new highway alignment. This would remove the informal parking at the end of this access road. This may impact on patronage to the commercial businesses in this area, however given it is not formalised parking, replacing the parking is not considered necessary. Informal parking would continue to be available in the adjacent streets and the Tall Timbers Hotel has provided sufficient parking for its customers.

**Amenity and land use**

The noise assessment in section 6.2 identified changes to noise levels. Noise levels would exceed relevant criteria at 39 properties. Nineteen of these properties are currently affected by acute noise levels.

The air quality assessment in section 6.9 found that carbon monoxide, nitrogen dioxide and dust levels around the study area are expected to be within the NSW air quality goals.

The proposed road widening would have an impact on the visual outlook for residential properties, with increased road surfaces and shared path. Depending on detail design, there may also be a noise wall at the rear of residences along Robert Holl Drive.

Urban design and landscaping (as per sections 3.2.8 and 6.5) would minimise visual impact of the proposal. It would provide a positive impact by using planted medians to break down the scale of the road, and tree planting to re-introduce green space and a tree canopy indicative of the local landscape character.

The potential inclusion of roadside noise barriers between 28 and 38 Robert Holl Drive would impact the visual amenity of road users and residents behind these properties, which may remove the semi-rural environment feeling that locals enjoy. The properties at this location would back onto the highway alignment, therefore shadowing of the house by the noise barriers should not be an impact. The barriers could also potentially improve the amenity of the residents at these properties by reducing noise levels at their property, including at outdoor facilities.

Widening the road would have a minor impact by removing an edge strip adjacent to the highway. This would require removal of affected trees. Access to the park would be improved by linking it with the shared path, however the shared path would remove some green space.

The perception of the area by the community may change from being a quiet, semi-rural area, to a busy community, split by a highway.

The provision of the shared pedestrian and cycle path along the length of the proposal provides a new community facility and increased recreational opportunities.

### 6.3.3 Safeguards and management measures

**Property**

If the RTA determines to proceed with the proposal, owners of properties directly affected would be contacted, and receive notification from the RTA of its intention to purchase all or part of the property. Property acquisition would be in accordance with the provisions of the *Land Acquisition (Just Terms Compensation) Act 1991*. The RTA Land Acquisition Information Guide (2011) details the procedures and process to be followed in the acquisition process and a copy is provided in Appendix C.

All residents at properties affected by disruptions to utilities such as water, gas, phone and power as part of the proposal would be given at least five days notice of any disruption to services, or as required by the relevant authority.
Accessibility

Consultation would be undertaken with residents and business owners where their access is impacted by the proposal. Such consultation would be undertaken prior to the commencement of works and would be undertaken in accordance with the RTA’s Community Involvement and Communications Manual (2008).

Where temporary access is modified during construction, impacted residents, businesses and community facilities would be notified at least five days prior in order to minimise disruption to access. Where access is affected, the RTA would maintain reasonable access to all properties in negotiation with respective land owners and businesses.

Notices relating to roadworks and changed traffic conditions would be advertised in local newspapers and letterbox drops at least five days prior to the change.

Emergency services, including fire, ambulance and police, would also be consulted to ensure that safe access is maintained during the construction period in the event of an emergency.

As part of the Community Consultation Strategy communication activities during construction would include, but would not be limited to, door knocks, newsletters or letterbox drops providing information on the proposed works, working hours to be adhered to and a contact name and number for complaints. These details would be included in the Construction Environmental Management Plan (CEMP).

A comprehensive signage scheme for pedestrians and cyclists would be developed to maintain a sense of connectivity across the highway and to encourage safe pedestrian activity.

Provision would be made for pedestrians and cyclists to detour around the construction site safely at all times and temporary bus stops would be provided where necessary.

A Traffic Management Plan including these details would be prepared and implemented to manage traffic during construction.

Local business

Access to all business operations and properties would be maintained during construction. Access to the Tall Timbers Hotel parking facilities would be maintained at all times.

The construction of the proposal would provide positive temporary economic benefits by providing employment opportunities and business for suppliers in the local region. Construction staff would potentially increase revenue at local businesses especially lunch facilities.

‘No parking’ signs would be erected to notify any changes to informal parking arrangements.

Amenity

A Construction Environmental Management Plan (CEMP) would be prepared for the proposal, which would incorporate all environmental safeguards and mitigation measures to be implemented during construction. This would include hours of work, minimising air, noise, dust, amenity and access impacts on the surrounding community.

A site-specific Construction Noise and Vibration Management Sub-plan, and Dust & Air Quality Management Sub-plan would be prepared and implemented by the construction contractor.

Community communications activities would also be used throughout the construction program to keep the community informed of timing / reasons for any works likely to cause a disturbance. A project hotline linked to the construction contractor would also be available for any complaints relating to construction.

The potential changes to the semi-rural perception of the local area would be mitigated through the landscape and urban design strategy, which minimises the visual impact of the upgraded highway, and seeks to maintain the characteristic plantings and trees of the existing area.
6.4 Traffic, transport and access

6.4.1 Existing environment

The Pacific Highway within the proposal area is a two-way single lane road. It has a posted speed limit of 60 km/h and 70 km/h. There are currently no traffic signals, roundabouts or pedestrian crossings located within this section of road.

There is direct residential and commercial property access on to the highway, and three local road intersections with the highway (Ourimbah Street, Teralba Street, Walmsley Road). There are no accelerating or decelerating lanes from these accesses. These access points cause traffic congestion on the highway during already strained peak hour conditions and a safety hazard at all times.

Existing traffic

Daily automatic traffic counts were conducted on the Pacific Highway in the proposal area for a seven day period from 30 March until 5 April 2009. The count locations were north of Glen Road in Ourimbah, and south of Ourimbah Street in Lisarow. Counts of turning movements at the intersections of the Pacific Highway with Glen Road, Walmsley Road, Teralba Street and Ourimbah Street were also undertaken.

Hourly vehicle flows passing through the two Pacific Highway count locations in both directions are shown in Figure 6-24 below. Traffic counts throughout the week are shown in Figure 6-25.

![Figure 6-24 Hourly traffic data summary](image)

The following key observations were noted from traffic data analysis:

- The Pacific Highway between Ourimbah and Lisarow carried around 29,000 vehicles per average weekday, and weekend traffic is about 25 per cent lower than weekday traffic.
- The Pacific Highway between Ourimbah and Lisarow carried between 1,600-1,800 heavy vehicles per day, which was 5.5–6 per cent of total traffic. The proportion of heavy vehicles is substantially higher during the morning peak than afternoon peak hour.
- Thursday showed the highest traffic volume, which were recorded as 3.4 per cent and 4.3 per cent higher than the average weekday at the two monitoring locations.
- The morning peak occurred between 7 am and 8 am, and the afternoon peak occurred between 3 pm and 5 pm. Peak volumes were between 6.8 per cent and 8.2 per cent of daily volumes at the two monitoring locations.
• Side streets including Walmsley Road, Teralba Street and Ourimbah Street carried relatively small traffic - between 30 and 100 vehicles per hour.

![Daily traffic profile north of Glen Road, Ourimbah](image)

**Figure 6-25** Daily traffic profile north of Glen Road, Ourimbah

**Accident history**

RTA crash data is available for a six year period from 2003 to 2008 for the highway between Glen Road and Railway Crescent. The total number of crashes for the six year period was 26. In order of severity, those crashes were classified as shown in Table 6-32.

**Table 6-32 Summary of crash data for the period 2003-2008**

<table>
<thead>
<tr>
<th>Location</th>
<th>Total Number of Crashes</th>
<th>Fatal Crashes</th>
<th>Injury Crashes</th>
<th>Non Injury Crashes</th>
<th>Fatal Injured Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacific Highway, south of Glen Road to south of Ourimbah Street</td>
<td>26 (100%)</td>
<td>2 (7.7%)</td>
<td>8 (30.8%)</td>
<td>16 (61.5%)</td>
<td>2 19 21</td>
</tr>
</tbody>
</table>

Crash data for the intersections are also included in the above statistic.

The crash data analysis shows that the ‘rear end’ crashes dominated with eight (31 per cent) occurrences. The majority of crashes occurred during fine weather conditions (58 per cent).

Pedestrians were involved in three of these crashes, resulting in the two fatalities and one injury. Fatal crashes occurred about 150 m north of Walmsley Road and 50 m south of Glen Road. Both fatalities occurred during the night time while the pedestrian attempted crossing the highway.

Figure 6-26 shows crash locations on the highway between Glen Road and Railway Crescent.
Existing level of service

The capacity of roads is often used to assess when a particular road section may require widening or duplication. The Level of Service (LoS) is graded ‘A’ to ‘F’, as per Table 6-33.

Table 6-33 Level of Service criteria for intersections

<table>
<thead>
<tr>
<th>Level of Service</th>
<th>Traffic Signals, Roundabout</th>
<th>Give Way and Stop Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Good operation</td>
<td>Good operation</td>
</tr>
<tr>
<td>B</td>
<td>Good with acceptable delays and spare capacity</td>
<td>Acceptable delays and spare capacity</td>
</tr>
<tr>
<td>C</td>
<td>Satisfactory</td>
<td>Satisfactory, but accident study required</td>
</tr>
<tr>
<td>D</td>
<td>Operating near capacity</td>
<td>Near capacity and accident study required</td>
</tr>
<tr>
<td>E</td>
<td>At capacity.</td>
<td>At capacity; requires other control mode</td>
</tr>
<tr>
<td></td>
<td>At signals, incidents will cause excessive delays.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Roundabouts require other control mode</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Unsatisfactory with excessive queuing</td>
<td>Unsatisfactory with excessive queuing; requires other control mode</td>
</tr>
</tbody>
</table>

Pacific Highway

The capacity of the Pacific Highway was modelled in a study in 2009 using the Central Coast traffic model for both AM peak period (7-9 am) and the PM peak period (4-6 pm) traffic conditions. The study indicated that the Pacific Highway between Ourimbah and Lisarow has varying capacity along its corridor, but is largely approaching its capacity. Currently its level of service (LoS) is rated A (good operation). This is because the level of service calculations for the Pacific Highway do not take into account the LoS of the intersecting roads. As these intersections are uncontrolled the highway traffic takes precedence and flow is not impacted. The LoS for the intersecting roads are outlined below.

However with the introduction of traffic lights at these intersections the LoS for this section of the Pacific Highway, at opening year of 2012 would be rated B (good with acceptable delays). The widening of the road to four lanes (two in each direction) would assist with this rating ensuring continued good LoS on the Pacific Highway.

Intersections

At the three local road intersections with the highway (Ourimbah Street, Teralba Street, Walmsley Road), average intersection delay is measured by level of service (LoS). Analysis of current traffic data indicates that:

- Both Pacific Highway/Walmsley Road and Pacific Highway/Teralba Street intersections show a good LoS between B and C during peak hour.
- Pacific Highway/Ourimbah Street intersection shows a Level of Service F. The current ‘give way’ arrangement allows no staged crossing for critical right turn out from Ourimbah Street resulting extended delays with lower LoS.

Pedestrian and cyclist facilities

There are no formalised footpaths along the Pacific Highway. Pedestrians use either the gravel edges, grassy verges of the road or the road pavement. In addition, no formalised crossing facilities (such as a signalised intersection) currently exist to traverse the highway from east to west, to access bus stops, commercial properties or the Baileys Road pedestrian bridge over the railway.

There are no formalised cycle ways and cyclists currently use the shoulder of the road.

Access to southbound bus stops on the eastern side of the highway is difficult during peak hours.

Public transport

The highway serves as the part of the route for one bus service between Gosford and Tuggerah - Busways Route 36. Busways Route 37 also runs between Gosford and Tuggerah, but runs to the east of the study area through Wyoming Rd and Settlers Park.

Seven bus stops are located on both sides of the highway. They are positioned adjacent to each intersection, with one adjacent to Lisarow Cemetery. Two of the bus stops have bus shelter facilities, however others are only signposted.

The highway runs parallel to the Main Northern Railway Line which runs both inter-city (Newcastle – Sydney) and suburban trains (Central Coast Line). The existing train stations at Ourimbah and Lisarow are beyond the extent of this proposal.

Access

Access to and from properties in the study area is addressed in Section 6.3.
6.4.2 Potential impacts

Construction

The construction of the proposal would likely have the following impacts on traffic and access arrangements for the local area:

- A lower speed limit of 40km/h would likely need to be implemented throughout the construction period to provide for the safety of workers and motorists in the changed traffic conditions. This would likely cause slight delays to travel times of vehicles through the construction area.

- Access for pedestrians and cyclists would be maintained at all times throughout construction. However for safety purposes slightly longer detours of footpaths may be required impacting travel times of pedestrians and cyclists through the construction area. This is likely to cause minimal inconvenience to users, but is necessary to maintain their safety.

- Access to private properties would be maintained at all times, however slight delays in getting into or out of private access points may be experienced throughout construction.

- Vehicle and pedestrian access to bus stops would be maintained, however the temporary relocation of bus stops may be required throughout construction. This may require additional walking distances to some bus stops for some residents. This impact would be a minimal inconvenience to users and bus companies and would be temporary.

Construction of the proposal is expected to commence in 2013. As this proposal is one of a number of upgrades to the Pacific Highway in this region (as outlined in section 1.1) there is potential that stages 3B and/or 4 may commence construction while construction of this proposal is still underway. These cumulative works may impact on traffic congestion and travel times in the short-term. These impacts and other cumulative impacts of these projects occurring at the same time as this proposal would be considered as part of the environment assessment for those projects if this occurs.

Operation

The Central Coast is expected to experience a substantial growth in population over the next 20 years. The *Central Coast Regional Strategy* was published in 2008 to provide policies and actions to plan for the regions projected population and employment growth up to 2031. The Transport Data Centre (TDC) projections suggest about a 90,000 increase in population and employment is projected to grow by about 27,000 jobs for the Central Coast between 2006 and 2031.

Using an opening year of 2012, computer traffic models were used to assess the potential impact of the long-term growth in the Pacific Highway corridor. The base traffic count data was from 2009, and models were then developed and then calibrated to forecast demand and operational characteristics for future years 2012, 2016, 2026 and 2031.

Table 6-34 presents the modelled weekday daily two way traffic forecasts for both directions for opening year 2012, and 20 years after the opening in 2031. The forecasts indicate that the Pacific Highway would carry between 30,000–32,000 vehicles per day in 2012, increasing to 43,000–45,000 vehicles per day in 2031.

Table 6-34 indicates that traffic is forecast to grow at 2.7 per cent per annum between 2009 and 2012, and about 1.8 per cent per annum between 2012 and 2031. The higher growth rate between 2009 and opening year 2012 is expected due to induced traffic from the four lane upgrade, as the additional capacity from widening the highway would divert minor volumes of traffic that previously used the F3 Freeway to access Gosford from the north.
### Table 6-34  Projected two-way traffic volumes

<table>
<thead>
<tr>
<th>Location</th>
<th>Existing 2009</th>
<th>Opening year 2012 base case with Stage 3A upgrade only</th>
<th>2031 Stage 3A Base case with Stage 4 upgrade</th>
<th>Annual growth rate Between 2009 and 2012</th>
<th>Annual growth rate Between 2012 and 2031</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacific Highway, north of Glen Road</td>
<td>29,600</td>
<td>32,100</td>
<td>45,200</td>
<td>2.7%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Pacific Highway, north of Railway Crescent</td>
<td>28,300</td>
<td>30,700</td>
<td>43,600</td>
<td>2.7%</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

Modelling also showed that the route selected for the proposed stage 4 upgrade (either the Pacific Highway or Narara Valley Drive) would not impact on traffic flows in the Stage 3A proposal.

**Highway level of service**

The ‘do nothing’ option was modelled for the proposal, and resulted in a low level of service of D (approaching capacity) in 2031. This level of service would not meet project objectives, resulting in regular congestion during weekday peak periods. There would be increased use of local streets by traffic seeking to avoid areas of severe congestion on the Pacific Highway.

Modelling of the preferred option indicated that by 2031 the Pacific Highway with Stage 3A operational is expected to maintain a high level of service (B and C) indicating no capacity issues for both AM and PM peak periods. The expected level of service for the opening year (2012) would be high (B).

The modelling showed that there would be a positive impact from the proposal, which would meet project objectives (operating at a level of service C or better 20 years after opening (2032) and level of service B or better on opening (2012)).

**Intersections level of service**

The ‘do nothing’ option was modelled, and resulted in a level of service of F (unsatisfactory with excessive queuing) at all intersections during peak periods for 2032 traffic levels, which would not meet project objectives. Road safety would be expected to deteriorate, as drivers become impatient in seeking access to the Highway.

Modelling of intersections and local roads in the preferred option in 2032 were analysed using intersection analysis software. The analysis indicated that:

- The Ourimbah Street signalised intersection is expected to experience level of service A (good operation) in both AM and PM peaks.
- The Teralba Street signalised intersection is expected to experience level of service A (good operation) in both AM and PM peaks.
- The Walmsley Road signalised intersection is expected to experience level of service B (good with acceptable delays and spare capacity) in both AM and PM peaks.

The proposed entry ramp from the light industrial area near Walmsley Road was checked for acceleration at 70 km/h, and the level of service was expected to be satisfactory (level C).

The modelling showed that there would be a positive impact from the proposal, which would meet project objectives (operating at a level of service C or better 20 years after opening (2032) and level of service B or better on opening (2012)).
Public transport

The proposal is expected to have a positive effect on public bus transport, through the implementation of dedicated bus bays, bus priority at selected intersections and improved access to bus shelters. The project is not expected to have an impact on public rail transport in the local/region area.

Summary

The proposal would have a positive long term impact on traffic and transport due to:

- Increased safety for road users, including pedestrians and cyclists.
- Improved conditions for cyclists, pedestrians and bus users.
- Upgraded intersections providing improved access to and from local roads.
- Reduction in traffic conflicts along the highway.
- Improved pavement, drainage, line marking and lighting.
- Reduced frequency of maintenance works on the new pavement.
- Improved level of service and capacity to safely carry expected future increases in traffic.

6.4.3 Safeguards and management measures

Construction

A Construction Environmental Management Plan (CEMP) would be developed prior to construction and would include a construction traffic management sub-plan. This plan would include the following measures:

- The local community would be informed of changed traffic conditions and any likely access disruptions.
- Measures to reduce use of back routes throughout construction would be implemented.
- Community information sessions would be held if and when required.
- An information hotline and a complaints register would be established for the pre-construction and construction phases to address community issues and provide updates on project status.
- A minimum of one traffic lane would be available at all times during construction.
- Traffic management measures would be established to keep road users informed, including the use of temporary speed limits, line marking, warning signs, traffic control and temporary barriers and markings.
- Safe access for pedestrians and cyclists around work areas would be provided at all times.
- A thoroughfare for emergency vehicles would be provided at all times.
- Access to private properties would be provided at all times. Residents would be notified if works are likely to cause delays in accessing their properties,
- Access to temporary bus stops would be provided as close as possible to the location of existing bus stops.
- Works that would be disruptive to traffic flows would be undertaken outside of peak hours where possible.
Operation
- Local residents and the general community would be informed about changed access arrangements at the beginning of operation of the new road.
- At opening of the proposal monitoring of the new traffic signal intersections would be undertaken to ensure that the sequencing and timing of the lights appropriately manages traffic accessing the Pacific Highway after opening of the proposal without extensive delays.

6.5 Landscape, visual and urban design

6.5.1 Existing environment

The section of the Pacific Highway covered by the proposal is currently an undivided dual carriageway, with no formal cycleway/footpaths. For most of the eastern edge it is bound by the Main Northern Rail Line. The western edge is a semi-rural assortment of house frontages and rear fences interspersed with pockets of green open space with mature established trees.

The distribution and frequency of built elements and vegetation along the corridor contribute to different character settings. In addition the topography, geology and watercourses lend themselves to specific landscape characters. Combined with the adjoining land uses, these form distinct precincts with specific visual qualities and characters as shown below in Figure 6-27. Precincts relevant to the proposal are described below.

![District precincts](image)

**Figure 6-27  District precincts**

Source: Hyder GIS

**The Hills**

This precinct is typified by a mixed eucalypt forest/freshwater wetland plant communities. Located south of the proposal (forming part of stage 3B), this area incorporates the hilly area surrounding the Railway Crescent intersection, Dora Street and Lisarow Cemetery.

The bushland vegetation along Cut Rock Creek on the eastern side of the railway corridor, a remnant patch of coastal warm temperate rainforest, is highly visible from the highway and contributes significantly to the character of this precinct.
The Flats

Passing through a flat topography between the southern limit of works and Lions Park, the character precinct termed ‘The Flats’ is typified by remnants of Swamp Sclerophyll Forest on Coastal Floodplain plant community with freshwater wetlands nearby.

It consists of stretches of low scale semi-rural residential development, which fronts on to the highway at the southern extent, and is set back from the highway to the north. Domestic garden landscapes with introduced exotic species transitions into a heavily vegetated bushland along the road edge where Cut Rock Creek runs parallel to the highway on the western side. Parts of these semi-rural and open space areas are zoned as environmental conservation areas under local planning instruments and over time have become heavily infested with weed species. Some remnant vulnerable plant species, namely the *Melaleuca biconvexa*, have been identified.

The entire eastern edge of this precinct is bordered by the railway corridor close to the edge of the highway. This area has been cleared by railway works and colonised by grasses and opportunistic plants. Beyond the rail corridor to the north east distant ridgeline views are visible.

Key detractors in the environment are the railway corridor and a series of high voltage power lines which are located between the rail corridor and road corridor on the eastern side. The high voltage power lines move across the rail corridor to the eastern side at Teralba Street. These constrain the road corridor which cannot move further west due to property boundaries and reduce the length of planted medians and street trees along the eastern edge of the road.

Ourimbah Township

Located at the northern end of the study area, this character precinct is characterised by the commercial strip of the Ourimbah township. The western edge of the precinct begins with the Lions Park, with established mature tree plantings of *Cinnamomum camphora* (Camphor Laurel) and *Liquidambar styraciflua* (Liquid amber) in an avenue arrangement. These provide a gateway entry feature to the township, particularly during Autumn with a colourful show of colour. Lions Park provides a pleasant shady public open space with a playground and picnic facilities, and is highly valued by the local community.

The western edge continues as a mix of low scale, residential development and mixed business such as the Tall Timbers Hotel and associated bottle shop, and Ourimbah Thai restaurant, ending at Glen Road with a cluster of retail shops. This mixture of uses provides a discontinuous street edge with poor pedestrian amenity. Some retail premises which have generous setbacks often have 90 degree car parking in front of the premises, creating at times a difficult and unsafe pedestrian environment due to a lack of footpaths. These car parking spaces would not be impacted by the proposal.
to north, consist of an empty lot, a modular sheds supplier, a landscape material supplier, a fitted wardrobe supplier, Ourimbah Veterinary Hospital and the Metro Petroleum service station.

### 6.5.2 Potential impacts

During construction, the visual amenity of the area would be impacted by the presence of construction works, machinery, fences and road barriers and signs. These impacts are necessary to enable the safe construction of the proposal. They would be temporary and minimised where possible.

The potential landscape character impact of the proposal during operation includes:

- A decrease in the semi-rural road character, and the feeling of a ‘green corridor’, as a result of loss of roadside vegetation.
- Diminished appreciation of the spatial quality of the road situation on the valley floor surrounded by ridgelines.
- An altered scale of the road and landscape, due to widening the carriageway from two to four lanes in addition to shoulders, turning lanes and bus bays. This dramatically changes the scale of the existing road to become a busy urban road up to six lanes in width in places.
- Impacts to the quality of landscape amenity due to property acquisition of parts of both private and public open space including gardens and parkland to allow road widening.
- Change of character due to the potential introduction of a noise wall at the rear of properties at 28 to 38 Robert Holl Drive.

The potential visual impact of the proposal would be caused by:

- Increased prominence of pavement area and roadside elements such as the potential noise wall, extended culverts over Cut Rock Creek, traffic lights, and street lighting upgrades.
- Impacts from removal of vegetation in the north-east corner of Lions Park and in residential areas.

### 6.5.3 Safeguards and management measures

The following measures would be implemented to minimise impacts to landscape character:

- Landscaping made up of indigenous species, including large tree species would be established along the road corridor. These would help to complement the existing natural environment and re-introduce a tree canopy to soften the impact of road.
- Road shoulders would be softened, within road safety guidelines, using vegetation throughout the proposal to aid a water sustainable design and to reinforce the semi-rural nature of the area.
- Concrete kerbing would generally be used at the new intersections and their approaches, where the shared path abuts the road corridor, and in Ourimbah.
- If roadside noise barriers are required, the barrier would be developed with the appropriate height, structure and finishes to be sympathetic to the surrounding environment.

The following measures would be implemented to minimise impacts to visual amenity:

- Batters would be designed to a minimum ratio of 1 in 3 to aid revegetation of the area where feasible and reasonable.
- Removal of endangered or large mature trees would be minimised by installing retaining walls to reduce the construction footprint where feasible and reasonable.
- Aesthetic and landscape treatments to any potential noise barriers would be of equivalent quality to both sides.
- Medians would be vegetated, where possible and within road safety guidelines, to break down the scale of the road and lessen the impact of the road widening, reinforcing the sense of a ‘green corridor’.
- The shared path would be separated from the edge of the road by a minimum 1.5 metre planted verge where possible and within road safety guidelines. This would reinforce the green corridor and provide a visual and physical break to a continuous paved surface.
- Overhead low voltage power lines would be relocated underground, to reduce visual clutter and allow for new landscape treatments.

6.6 Aboriginal heritage

An Aboriginal heritage assessment was undertaken by Cosmos Archaeology in May 2010, which is provided in Appendix F. The assessment was undertaken for a six kilometre by seven kilometre region at the study area. The assessment includes a general Aboriginal history of the area.

6.6.1 Existing environment

The study area is within the traditional boundaries of the Darkinjung people. Ourimbah was an important area to the Darkinjung people as important ceremonial sites were located to the west and east along the ridges. ‘Ourimbah’ means the sacred circles or belt, and as a place of initiation it was a central gathering place of the clan groups that made up the Darkinjung people.

The Aboriginal heritage assessment completed in the preliminary environmental investigation (Environmental Assessments, 2008) found no previously recorded Aboriginal heritage sites located within or immediately adjacent to the proposal.

The assessment included a site inspection and a search of the NSW Office of Environment and Heritage (formerly Department of Environment, Climate Change and Water) Aboriginal Heritage Information Management System (AHIMS) in November 2007. The search showed numerous Aboriginal heritage sites within a seven by six kilometre search area (identified as the study region), none of these were located within the study area. A later search was undertaken in March 2009. No changes to Aboriginal heritage sites were noted.

None of these sites were located within or immediately adjacent to the study area. No new Aboriginal heritage or archaeological sites had been added to the register between 2007 and 2010. A search of the Environment Protection and Biodiversity Conservation Act 1999 registers found no Aboriginal heritage sites in the study area.

A walkover survey of the proposed route was conducted in 2008 between Glen Road, Ourimbah and Dora Street Lisarow with a representative from the Darkinjung Local Aboriginal Land Council. This was an external preliminary assessment, as required by the RTA’s Procedure for Aboriginal Cultural Heritage Consultation and Investigation. The survey did not locate any additional unrecorded Aboriginal heritage or archaeological sites within the project area. The Darkinjung LALC concluded that no further Aboriginal heritage or archaeological work was required and they had no objections to the proposal continuing.

As the proposed upgrade route corridor had not altered since the completion of the preliminary environmental investigation, the recommendations made in the Darkinjung LALC report are still applicable for this stage of the proposal.
6.6.2 Potential impacts

The construction of the proposed development would have no impact on known Aboriginal heritage values as no Aboriginal heritage or cultural sites were identified within the study area.

6.6.3 Safeguards and management measures

- In the event that any Aboriginal objects are uncovered during construction, works would cease immediately within the vicinity of the find and guidance would be sought from the regional RTA Aboriginal Cultural Heritage Advisor.
- As part of the site induction, construction personnel would be notified of the requirement to stop works and notify supervisors if any unknown items are found during construction.

6.7 Non-Aboriginal heritage

A Statement of Heritage Impact for non-Aboriginal heritage relating to the proposal was undertaken by Cosmos Archaeology in June 2010, and is provided in Appendix F. This includes a general non-Aboriginal history of the area.

6.7.1 Existing environment

The non-Aboriginal heritage study completed as part of the Statement of Heritage Impact searched the following registers for heritage items in the study area:

- LEP heritage schedules of Gosford and Wyong councils.
- NSW State Heritage Register.
- RTA Section 170 Heritage & Conservation Register.
- RailCorp Section 170 Heritage & Conservation Register.
- National Heritage List.

The report identified two heritage items potentially impacted by the proposal. These are summarised in Table 6-35. These sites were identified from a 200 metre wide corridor established around the proposal to take into consideration any variation of the concept design.

<table>
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<tr>
<th>Name</th>
<th>Date</th>
<th>Location</th>
<th>LOT/DP</th>
<th>Item No.</th>
<th>State or Local Significance</th>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Ourimbah Thai Restaurant / 'Scotty's Take Away'</td>
<td>Not listed</td>
<td>21 Pacific Highway, Ourimbah</td>
<td>5/20283</td>
<td>30</td>
<td>Local Significance</td>
</tr>
<tr>
<td>Gosford Local Government Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lisarow Anglican Cemetery</td>
<td>c.1858</td>
<td>Dora St/ Pacific Hwy, Lisarow</td>
<td>21/605640</td>
<td>169</td>
<td>Local Significance</td>
</tr>
</tbody>
</table>

Ourimbah Thai restaurant building

The Ourimbah Thai Restaurant/Scotty's Take Away building is located at 21 Pacific Highway opposite the northern entrance to the access road to the shops off the Pacific Highway. It is currently used as a take away shop/restaurant. The statement of significance outlined for this...
property by the Wyong Council heritage study states it is of ‘(At least) of local historic and aesthetic (streetscape) significance in defining the Ourimbah Township’.

**Lisarow Cemetery**

**History**

A Church of England reserve appears to have been established shortly after the land was granted to Robert Cox in 1838. The first recorded burial in the cemetery was in 1841, and the first temporary church within the reserve was built around 1858. No evidence was found that structures or other features existed prior to the granting of the reserve. The original reserve extended from Ourimbah Street to Dora Street and from Wallarah Street to the highway.

The current boundary was established by a stone and iron gate and fence built on the site in 1934. It is not certain that this boundary was the original boundary of the Church of England Reserve, and the cemetery, or whether the boundary was further to the east where the original Pacific Highway alignment was.

Within the current layout of the cemetery there are 17 rows of burials and additional informal spacing. There are reportedly 261 burials in unmarked graves as well as an additional 251 unmarked burials whose location within or around the cemetery are not known. The small size of the current boundary of the cemetery and the limited amount of vacant space raises the possibility that the boundary of the cemetery was once larger than it appears currently, or that the location of some burials have been lost and recent burials have been placed on top of the older unmarked graves.

The vacant area between the first row of burials and the Pacific Highway in the northeast corner of the site is wide enough to potentially have unmarked graves present. Any headstones in this area may have been removed as a result of landscaping for drainage purposes. However, it is not known if or when this work may have been done.

A ground penetrating radar survey that was completed for the site found five potential burial locations between the first row of burials in the cemetery and the property boundary. No burial locations were detected between the current Pacific Highway and the boundary of the cemetery. The survey also located what is believed to be a utility service located between the current road boundary and the cemetery boundary. However metallic material within this area interfered with the results of the survey.

It is unlikely that burials are present immediately to the south of the current boundary of the cemetery, as this area contains large stands of mature trees before the ground drops down steeply to the Pacific Highway. The ground penetrating radar was not able to survey this area due to the vegetation coverage and stones that obscured the ground.

The south-western section of the allotment near Dora Street contains large stands of mature trees with dense weed ground coverage. No evidence of burials, buildings or other structural remains could be seen in this area, however, the ground visibility did not allow for a thorough examination of this area.

**Statement of Significance**

The Lisarow Cemetery at the corner of the Pacific Highway and Eagle Close, Lisarow, has rare local historic and social significance as a mid-19th century cemetery associated with the early settlement of the district. Set above the Pacific Highway, the cemetery is an important feature of the landscape.
6.7.2 Potential impacts

Ourimbah Thai restaurant building

The concept design for the proposal has been designed to avoid any direct impacts on the Ourimbah Thai Restaurant building. As discussed in section 6.2, vibration levels would not exceed criteria for heritage structures.

As discussed in section 6.2, vibration levels during construction would not exceed the relevant criteria for building damage to heritage structures.

Lisarow Cemetery

There would be no direct impacts to the cemetery grounds as a result of the proposal. There is potential for minor impacts to the areas adjacent to the cemetery between the cemetery and the existing road alignment. Construction of the shared path and tie-in to the existing highway alignment would be required in the immediate vicinity of the cemetery boundary and existing gate. This would involve building up the current road level slightly, and battering the edge of the road. The extent of the works would not proceed further than the current boundary of the cemetery. The potential for graves to be present between the edge of the current road and the cemetery gates is considered to be low. There are no visible burials in this area.

The 1934 stone and metal gates situated on the eastern boundary of the cemetery would remain in their current position and would not be impacted by the proposal. There is the potential for indirect or accidental impacts damaging these gates during construction.

6.7.3 Safeguards and management measures

Lisarow Cemetery

- An archaeological test excavation would be conducted in the area between the eastern property boundary of the cemetery and the Pacific Highway prior to construction to determine the likelihood of unmarked graves. The work would be carried out by a suitably qualified archaeologist under an Exception Permit granted by the Office of Environment and Heritage under s139(4) of the Heritage Act 1977.

If unmarked graves are located within this area, works in this area would cease immediately and further consultation with the Office of Environment and Heritage, the Department of Health and the local police would be undertaken.

- Protective measures would be established around the stone and metal gates during construction in this area.

- Construction workers would undertake an induction on the heritage value of these gates, the potential for unmarked graves and the general sensitivity of the cemetery area during construction.

Unknown items

- In the event that unknown non-Aboriginal archaeological items are uncovered during the excavation/construction phase, all works would stop in the immediate vicinity of the item and the RTA Environmental Officer and the Office of Environment and Heritage would be notified of the discovery.
6.8 Hydrology and water quality

6.8.1 Existing environment

**Topography**

The topography of the general region around the proposal is dominated by alluvial flats and an almost north-south aligned ridge west of the highway. The ridge crest has an elevation of about 100m AHD. East-facing slopes have gradients of generally between 10° and 20° at the southern end of the alignment. The remaining alignment follows the existing highway over alluvial flats along the toe of the ridge slopes. The elevation of the alluvial flats is typically between 25m and 30m. The topography of the site changes from the southern section of the road which comprises low hills near the Railway Crescent intersection, before levelling out to the north into a floodplain.

The study area for the hydrology assessment includes the proposal alignment and up to a 150 metre buffer on all sides of the proposal.

Figure 6-29 shows the topography and watercourses in and around the study area. Red arrows in the figure indicate where the highway and railway cross Cut Rock Creek. These highway crossings would be directly affected by the proposal.

![Figure 6-29 Topography in the vicinity of the proposal](image)

Note: Arrows indicate locations where the highway and railway cross Cut Rock Creek
Source: Hyder GIS

**Catchments**

As shown in Figure 6-30, the proposal is wholly located in the Cut Rock Creek catchment (shaded in blue). Cut Rock Creek flows into Bangalow Creek around 200m downstream of the study area, which in turn joins Ourimbah Creek just downstream of the Ourimbah Creek weir. The catchment finally discharges to Tuggerah Lakes six kilometres to the north east.
Water Quality

Water quality in Cut Rock Creek appears to be suitable for aquatic ecosystems. As per section 6.1.2, native aquatic species were identified during field investigations.

Flooding

The 100 year average recurrence interval (ARI) flood extent used by Wyong and Gosford Councils is shown in Figure 6-31.

The relatively flat terrain adjacent Cut Rock Creek between Lisarow and the downstream extent of the project near the Main Northern Railway crossing of the creek experiences widespread flooding, including areas of residential development between Ourimbah Street and Teralba Street.

The steeper peripheral areas of the catchment drain to the floodplain. The inundation of the floodplain is exacerbated due to the rail embankment, which traverses the floodplain, and two constrictions in the creek, which are:

- The Cut Rock Creek culverts and rail culverts (upstream crossing).
- The Cut Rock Creek bridge over the Pacific Highway.

These structures constrain the flow in the creek which results in higher water levels upstream. In addition, the combination of the flat nature of the floodway and heavily vegetated areas acts to decrease the rate of flow and consequently increase the flood levels, particularly between the Teralba Street bridge and the Pacific Highway bridge.

Large boulders have been placed at the exit of the existing culverts to impede flow and balance flooding between the eastern and western sides of the highway at this location.

Previous flood studies indicated that a low point of the existing highway just south of the Cut Rock Creek bridge is overtopped during flood events equal to or larger than the 1 in 50 year ARI. This results in flood flows between the rail and road corridors, towards the rail bridge. Both the downstream and upstream Cut Rock Creek crossings (i.e. the existing Pacific Highway bridge and culvert system) have sufficient capacity to convey the 1 in 100 year ARI year flood flows without overtopping.

Flood modelling was undertaken for the Cut Rock Creek catchment to assess any changes to flooding that may result from the proposal over time. The 100-year ARI design storm event was modelled for the 1 hour, 2 hour, 4.5 hour, 6 hour and 9 hour durations. The 6 hour event was determined to produce the peak flood levels within the catchment adjacent to the proposed alignment (termed the ‘peak 100-year ARI design event’).

Local stormwater drainage

Stormwater generally flows to grassed table drains either side of the Pacific Highway, which lead to Cut Rock Creek. There is currently no formalised water quality treatment for stormwater runoff from the existing highway pavement.

Modelling of the existing drainage system indicates that in most areas outside of the floodplain, the piped drainage system is capable of conveying flows up to and including the 1 in 100 year ARI event.

No spill containment systems are in place along the existing highway.
Figure 6-30  Waterways in and adjacent to the proposal
Source: Hyder GIS

Figure 6-31  1994 100 year ARI flood extent adjacent to the proposal
Source: Gosford City Council, Wyong Shire Council, Hyder GIS
Groundwater

Geotechnical investigations at the study area were undertaken by Golder Associates (Golder Associates, 2009). These are included in the Contaminated Land and Groundwater Assessment, which is attached as Appendix H. The investigations identified that groundwater was between 0.6 to 3.1 metres below ground surface, reflecting the proximity to watercourses. At the three locations where groundwater monitoring wells were installed, groundwater was detected at around three metres below ground surface.

The results of the groundwater investigations indicated elevated concentrations of petroleum hydrocarbons (TPH C10-C36 and PAH) (including naphthalene, phenanthrene, anthracene and fluoranthene) in groundwater monitoring wells adjacent to the existing service station along the Pacific Highway adjacent to the proposal. The investigation did not indicate that contamination levels present a significant risk of harm to human health or the environment, if they remain undisturbed.

For further information/assessment of contaminated sites and lands refer to section 6.12.

Climate Change

Future climate projections are available from the Australian Climate Change Science Program run by the CSIRO, Bureau of Meteorology and Australian Greenhouse Office. Projections have been developed for a number of parameters for the years 2030, 2050 and 2070, which are compared to the baseline of 1990.

The average projection for warming over Australia by 2030 relative to 1990 temperatures is about 1.0°C. Warming in coastal areas will be 0.7°C to 0.9°C. The projections show an increase in the average number of days over 35°C in all emission level scenarios.

The projections for rainfall show both increases and decreases at Australian locations. The change in annual average rainfall for the Central Coast is projected to be between -10 per cent and +5 per cent for low, medium and high emission models for the year 2030 relative to 1990. An increase in daily rainfall intensity (rain per rainy day), as well as in the number of dry days is predicted. Changes to extreme weather events could increase flood frequency. These factors may in turn affect local water quality and hydrology.

The closest and most representative weather station to the study area is located at Narara, five kilometres southwest of Lisarow.

According to data from the Narara Research Station, the area experiences warm summers and mild winters. The mean 9am temperature ranges between 10.5°C in July and 22.9°C in January. Mean 3pm temperatures range between 16.1°C in July and 26.3°C in January. Relative humidity at Narara is consistently high throughout the year with highest relative humidity during March and lowest during October. Mean 9am relative humidity is higher than mean 3pm relative humidity throughout the year.

Data from at Narara Research Station show annual average rainfall of 1319.3 mm. February and March are the wettest months of the year, receiving 153.4 and 150.4 mm of rain respectively. August and September are the driest months of the year, with 74.0 and 68.5 mm respectively. The number of rain affected days reflects this trend, with March also receiving the most number of rain days and July and August the least.

The high rainfall in the area can cause flooding in the Cut Rock Creek catchment, as discussed in Section 6.8.

In general, the significant wind directions for the area are south-easterly and north-westerly winds. The south-easterly winds occur predominately in the summer months while north-westerly winds are more common in the winter months. Calm winds less than 0.5 m/s occur for around 25 per cent of the time in winter afternoons. Annual average wind speeds for the area are between 2.1 m/s and 2.8 m/s in the morning and afternoon, respectively.
6.8.2 Potential impacts

Construction

Construction of the proposal could potentially degrade water quality and affect hydrology in the immediate parts of Cut Rock Creek, and downstream in Bangalow Creek, through:

- Increased sediment load and organic matter from excavations for the culvert extension and weir, demolition of the existing bridge, and other exposed areas. This would impact aquatic flora and fauna.
- Increased turbidity which would reduce photosynthesis in the water column.
- Scouring at outlets from concentrated stormwater discharge or flooding.
- Increased gross pollutants and litter which would impact aquatic flora and fauna.
- The construction of the culverts, weir and levees would require the diversion of the creek line into just two culvert cells (as opposed to the current four cells). This would potentially increase flows in this area while the diversion is in place, which could change creek structure.
- Potential for flooding of creek lines or flood plain during construction may lead to erosion of soil and distribution of sediments into local water ways. There is also potential for contamination of flood waters from machinery or chemicals stored on construction sites.

It is unlikely that there would be any disturbance of contaminated groundwater, as depths of groundwater are below excavation depths of around one metre.

Operation

Stormwater

The proposal could increase runoff and concentrate flows to the existing water courses due to the increased impervious areas of pavement and replacement of some grassed table drains with formal drainage. Operation of the road could also increase the amount of nutrients, sediment, chemicals, metals, oils, litter, rubber and particles discharged to Cut Rock Creek due to greater traffic on the highway.

Flooding

The proposed alignment closely follows the existing highway alignment, with alterations to carriageway width, batters, and changes in levels to the southbound carriageway between the Cut Rock Creek bridge and Teralba Street.

Modelling of the proposed highway upgrade indicates that the removal of bridge support structures from the waterway at the existing Cut Rock Creek bridge through the provision of single-span bridges has the potential for a minor improvement (less than 50 mm) in flood levels during the 100 year ARI event between Teralba Street and the proposed bridge. This improved flow through the proposed bridge opening delivers floodwater more effectively downstream of the bridge. While this increases downstream flood levels up to 50 mm, this localised increase in flood level does not extend beyond the existing rail bridge or impact privately owned or occupied land.

The extension of the existing Cut Rock Creek culverts to allow for the widening of the highway results in the improved flow of floodwater to Cut Rock Creek west of the Pacific Highway. This, however, results in an increase in flood levels during the 100 year ARI for properties adjacent to the culvert exit (near the corner of Ourimbah Street and Pacific Highway) of around 30 mm. Additionally, there is an impact of up to 50 mm in the 100 year ARI event for properties located at 1014 and 1016 Pacific Highway due to both increased flow delivery from the culvert extension and alterations in levels along the proposed service road.
A flood study was undertaken to determine the potential impacts of flooding that the proposal may have on local flooding patterns and what impacts local flooding patterns might have on the functionality of the proposal during operation. As part of this study a number of flood mitigation/management measures have been incorporated into the concept design for the 1 in 100 year flood event. These inclusions are considered to be part of the proposal description as outlined in section 3 of this REF and are outlined as safeguards for flooding below in section 6.8.3. These inclusions would allow for better water distribution along the creek line and the protection of adjacent properties, as well as provisions for a flood free road surface in locations where it currently overtops in high rainfall events.

These design measures would be confirmed at the detailed design phase of the project, where the final sizing, optimisation and specification of such measures would be determined.

**Accidental spill management**

A review of crash data (see Section 6.4.1) indicates 23 vehicle related crashes in the past six years within the study area. This is likely to reduce given the proposed road improvements, especially crashes causing fatalities and serious injuries.

The frequency of accidents involving fuel spills is likely to be low (less than every 10 years), and the severity of the resulting accident is considered minor. This would be a low risk event and therefore it would not be necessary to provide formal spill containment devices.

**Climate change**

The average predicted warming over Australia of about 1.0°C is not expected to have an effect on the proposed upgrade. The increased average number of days over 35°C may affect water quality, stormwater infrastructure, and the stability and/or durability of materials used for the proposed upgrade.

The sea level rise planning benchmarks are set at an increase above 1990 mean sea levels of 40cm by 2050. As the elevation of the alluvial flats is typically between 25m and 30m AHD, sea level rise would not affect the proposal.

With an increase in extreme rainfall, 100-year ARI flood events may occur more regularly. It is not possible to quantify this potential effect on the upgrade.

As discussed in Section 6.8, hydraulic flood modelling shows that the proposal would have minimal impacts on flooding behaviour of Cut Rock Creek. As such, if rainfall leading to 100-year flood levels occurred more often (eg as a result of potential climate change to the area), the drainage and flood measures contained in the design would still function effectively.

### 6.8.3 Safeguards and management measures

#### Detailed design

Appropriate best practice techniques from the following documents would be used during design development, including:

In addition:

- Reinforced earth retaining walls would be used where feasible and reasonable to limit embankment construction and potential erosion.
- Clearing riparian vegetation and disturbing creek banks would be minimised to accommodate stormwater management infrastructure.

**Construction**

During the construction phase appropriate soil and water management procedures would be adopted in accordance with:

- RTA QA Specification G36, Environmental Protection (Management System).
- RTA QA Specification G38, Soil and Water Management.

To minimise water quality impacts during construction:

- All clean water from off-site (undisturbed areas) would be intercepted and diverted around the site to prevent impacts to water quality if it were to run through the construction site.
- Runoff from disturbed areas within the construction site would be diverted through sediment and erosion controls for treatment before entering local water sources, as outlined below. This would include check dams, sediment fences and sediment basins.

The proposal has been broken down into construction catchment areas according to topography, as shown in Figure 6-32. Sediment basins would capture and treat runoff from the majority of catchment areas disturbed by construction. These basins are proposed:

- To convey stormwater and remain structurally sound in 20-year ARI design storms.
- Where the catchment is steep, the catchment is greater than 2500 m\(^2\) or the estimated soil loss exceeds 150 m\(^3\)/year.
- For the type F soils found in the area, the bulk of which are fine grained and require long residence time to settle in a sediment retention basin.
- To treat water to a Total Suspended Solids (TSS) level of 50 mg/L for storms up to 35 mm, which is the 5-day duration 80\(^{th}\) percentile event for the Gosford area.

The locations and size of sediment basins would be confirmed during the detailed design stage. Sediment basins would require positioning to avoid clearing of native vegetation and impacts to existing utilities.

For Catchment 6 it is not practical to construct a construction sediment basin as the catchment is too small and there is no available location. Enhanced erosion controls would be required in Catchment 6 based on the recommendations of a soil conservationist during development of the Erosion and Sediment Control Plan.
A Construction Environmental Management Plan (CEMP) would be developed prior to construction and would include a soil & water management sub-plan. The sub-plan would be prepared in accordance with the guideline *Managing Urban Stormwater - Soils and Construction* (Landcom, 2004) and would include the following safeguards:

- Clean water diversions would be installed to divert any off-site water around the site prior to the commencement of construction.
- Vegetation clearing would be kept to a minimum where possible.
- Disturbed areas would be progressively stabilised as they are completed.
- Catch/diversion drains would be established prior to commencement of earthworks.
- Temporary structures such as check dams and sediment fences would be installed in appropriate locations to prevent offsite movement of sediment.
- All stockpiles would be managed in accordance with the RTA's Stockpile Site Management Guidelines (2011).
- Drainage blankets would be used as required at the base of fill embankments.
- All washing out of concrete trucks would occur at a dedicated wash-out area within a construction compound or at their own facilities. No washing out of trucks would occur outside of formally allocated and protected areas.
- A management plan for any spills would be prepared and communicated to all staff.
- Hazardous liquids such as fuels/chemicals would be stored within an appropriately bunded area with an impermeable floor in accordance with Office of Environment and Heritage requirements.
- Plant and equipment would be stored within the compound sites when not in use, where appropriate.
- Daily checks would be undertaken of plant and equipment to check that there are no oil or fuel leaks.
- An appropriately bunded area would be provided for refuelling of vehicles. Vehicles are only to be refuelled within this area.
Weather forecasts would be checked regularly during construction to prepare for any potential heavy rain fall events or high winds.

If flooding is possible, construction equipment and chemicals would be removed from potential flood areas and stored appropriately.

Methods used to divert the creek line during construction of the culverts would be capable to manage a 1 in 10 year rainfall event, without spilling into the work area, and would also be designed to prevent changes to the creek structure.

Work areas would be fully cleaned of sediment and potential pollutants prior to re-establishing creek flows through the area, during the diversion of the creek for the construction of the culverts, weir and levees.

Works within the creek line would not commence if heavy rainfall events are predicted.

The soil and water management sub-plan would also include a dewatering procedure, primarily based on volume control and weather analysis.

The dewatering of sedimentation basins would be dependent on the final detailed design. Timing of discharge would be dependent on analysis of turbidity and suspended solids, or volumes exceeding the basin capacity. If possible, water would either be allowed to settle prior to dewatering or where appropriate, flocculated to achieve the appropriate water quality.

If water is flocculated to reduce sediment levels, the pH levels would be analysed prior to discharge. If discharge of water is not possible, or volumes exceed capacity of basins, dewatering would be to mobile trucks for disposal at a suitable licenced facility. If water is suitable for discharge, it would be released into natural drainage lines.

If dewatering or deep excavations below groundwater levels are required, further investigations would be required to determine the nature and extent of contamination and to determine its impact on the proposed construction works. If groundwater would be disturbed requiring remediation, a Contaminated Soils Remedial Action Plan would be prepared.

Construction materials would be selected to be durable at increased ambient temperatures.

**Operation**

**Stormwater**

During detailed design measures would be incorporated into the proposal to slow roadside surface flows as well as retaining road runoff pollutants during operation of the road. Features to be further developed during detailed design include:

- Vegetated swales, verges and table drains located on both sides of the highway between Cut Rock Creek culvert and Teralba Street, between Teralba Street and Cut Rock Creek Bridge and north-east of Cut Rock Creek bridge. This would reduce kerb and gutter and piped drainage systems, improving water quality and aligning with water sensitive urban design principles.

- Incorporation of median swales and soft landscaping treatments.

- Gross pollutant traps (GPTs) potentially located at low points prior to outlets to small water courses or small vegetated wetlands. GPTs would be proprietary systems such as Continuous Deflective Separation (CDS) units or an approved equivalent.

The RTA’s Water Policy (1997) would be used to design the operational measures to:

- Retain existing natural overland flows and the groundwater regimes.

- Maintain existing surface and groundwater flows and incorporate containment structures to contain and treat runoff to protect environmentally sensitive areas.

- Maintain existing elements such as natural channels, wetland and riparian vegetation, where possible.
Provide a stormwater management system which manages both the quality and quantity of stormwater as close to its source as possible, including devices which would treat stormwater and retain run-off so that the system changes the existing water regime by the smallest amount practical.

By implementing these design measures, the proposal could have positive impacts on water quality due to additional treatment compared to existing infrastructure.

**Flooding**

As outlined in section 6.8.2, the flood study undertaken during the development of the concept design has resulted in the following aspects being incorporated into the concept design and project description for the proposal.

- The culvert extension to be laid at 0.1 per cent grade to assist in the balancing of flows between the eastern and western side of the highway during large events.
- Construction of a 20 cm high weir at the immediate exit to the proposed culvert extension to also assist in the balancing of flows between the eastern and western side of the highway during large events.
- Extension of the small existing levees on both banks of Cut Rock Creek downstream of the culverts. The levees would be constructed for 35 metres downstream of the culverts, and be designed for a 1 in 100 year storm event.

These aspects have been included in the concept design and are included in the project description for this REF. These inclusions would adequately manage the flood issues for the proposal and Cut Rock Creek and potentially have positive impacts on flooding of the adjacent areas and Cut Rock Creek during operation of the road.

All these aspects would be carried forward and included in the proposal at the detailed design stage to ensure mitigation of the potential flooding impacts. If any of the above aspects are to be removed or altered at the detailed design stage, an investigation would be undertaken to ensure that their removal/alteration has no impacts to the management of flood waters.

In addition, the drainage system that crosses the two existing vehicular accesses to the railway corridor between the Pacific Highway and Teralba Street would be upgraded with 900mm diameter pipe culverts to ensure floodwaters do not flow across the proposed highway.

**Accidental spill management**

Preliminary assessments on the risk of spills during operation impacting adjacent environments suggest the risk is low. During detailed design further assessment would be undertaken to check this is still the case. If the risk is deemed to be significant, measures would be designed into the drainage system to prevent spillages from reaching the downstream ecosystems and waterways. Depending on stormwater treatments, these measures may include:

- Stormwater channels that can be temporarily bunded to contain runoff.
- Lockable shut-off valves provided at points that discharge to natural watercourses.
- ‘First flush’ tanks sized to contain 1.2 times the potential spill volume (typically 25,000 litres) from a road tanker.

**Climate change**

Flood and hydrology assessments have considered the potential impact of climate change on patterns for the proposal. The proposed flood safeguards/management measures for the proposal outlined above would adequately manage potential changes to rainfall events as a result of climate change for the proposal lifetime.
6.9 Air quality

6.9.1 Assessment methodology

An air quality assessment of the proposal was conducted by Wilkinson Murray in May 2010. The assessment report is contained in Appendix G. The issues addressed in the assessment included:

- Sensitive receiver locations.
- Existing air quality and local meteorology.
- Quantification of emissions from various segments of the road.
- Estimation of kerbside concentrations of roadway air emissions.
- Potential air quality impacts during construction.
- Potential air quality impacts during operation.

The area surrounding the proposal was reviewed to determine representative sensitive receiver catchment areas. The assessment identified six catchments along the proposed upgrade route, which are listed below and shown in Figure 6-33.

- W1 – west from the highway between Glen Road and Walmsley Road.
- E1 – east of the highway between Glen Road and the end of James Graham Lane.
- W2 – west from the highway from Walmsley Road to the end of Robert Holl Drive.
- W3A – west of the highway between Teralba Street and Ourimbah Street.
- W3B – west of the highway between Ourimbah Street and Railway Crescent.
- E2 – east of the highway.

Nanna’s House Childcare Centre near Lions Park was also identified as a sensitive receiver. There are no specific air quality criteria for childcare centres.

The potential for adverse air quality impacts at residences during road operation was assessed using the RTA’s Tool for Roadside Air Quality (TRAQ) air dispersion model. The model has been used extensively in NSW and is currently accepted by regulatory agencies as an appropriate conservative model for forecasting near field ground level pollutant concentrations of traffic on major roads.

The primary pollutants of concern are carbon monoxide, nitrogen oxides, particulate matter less than 10 micrometres, and lead. Air quality impacts for the opening (2012) and for ten years in the future (2022) were considered, using the traffic predictions outlined in Section 6.4.

Policy setting

Construction

Office of Environment and Heritage (formerly Department of Environment, Climate Change and Water) (DECCW, 2005) consider that residential areas begin to experience dust related nuisance impacts when annual average dust (insoluble solids) deposition levels exceed 4 g/m²/month, and that dust impacts would be at unacceptable levels when they reach 10 g/m²/month.

Office of Environment and Heritage dust deposition criteria in terms of maximum acceptable increases in dust deposition over the existing dust levels are presented in Table 6-36.
Table 6-36  Construction dust deposition criteria

<table>
<thead>
<tr>
<th>Existing dust deposition Level (g/m²/month)</th>
<th>Maximum acceptable increase over existing dust deposition levels (g/m²/month)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Residential</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

A visual inspection of the nature of the study area indicated that dust levels in the study area are likely to be in the order of 1 to 2 g/m²/month. Therefore an increase of 2 g/m²/month may occur before there was a perceptible degradation in air quality.

**Operation**

The National Environment Protection Council (NEPC) has determined air quality objectives for adoption at a national level, which are part of the National Environment Protection Measure (NEPM). The publication *Action for Air: 2009 Update* (DECCW, 2009) presents NSW air quality objectives which are consistent with the NEPM standard. The Office of Environment and Heritage air quality objectives are presented in Table 6-37.

Table 6-37  Summary of NSW air quality objectives

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Standard</th>
<th>Averaging Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>25 ppm or 30 mg/m³</td>
<td>1 hour maximum</td>
</tr>
<tr>
<td></td>
<td>9 ppm or 10 mg/m³</td>
<td>8 hour maximum</td>
</tr>
<tr>
<td>Nitrogen dioxide</td>
<td>0.12 ppm or 246 µg/m³</td>
<td>1 hour maximum</td>
</tr>
<tr>
<td></td>
<td>0.03 ppm or 62 µg/m³</td>
<td>annual mean</td>
</tr>
<tr>
<td>Particulate Matter &lt; 10 mm (PM10)</td>
<td>30 µg/m³</td>
<td>annual mean</td>
</tr>
<tr>
<td></td>
<td>50 µg/m³</td>
<td>24 hour maximum</td>
</tr>
<tr>
<td>Lead</td>
<td>1.5 µg/m³</td>
<td>90 day average</td>
</tr>
<tr>
<td></td>
<td>0.5 µg/m³</td>
<td>annual average</td>
</tr>
</tbody>
</table>

**6.9.2 Existing environment**

**Climatic conditions**

The closest weather station to the proposal site is the Narara Research Station (Gosford Australian Weather Station) located around five kilometres south of the proposal. In general, the primary wind directions for the area are south-easterly and north-westerly winds. The south-easterly winds occur predominately in the summer months while north-westerly winds are more common in the winter months. Calm winds less than 0.5m/s occur for around 25 per cent of the time in winter afternoons. Annual average wind speeds for the area are between 2.1 metres per second and 2.8 metres per second in the morning and afternoon, respectively.
Figure 6-33  Sensitive receiver catchments (coloured)

Source: Hyder GIS
Existing air quality

Local air quality with respect to carbon monoxide, nitrogen oxides and PM10 are monitored at selected Office of Environment and Heritage air quality sites at Wallsend and Newcastle, 70 kilometres north of the proposal. While no project specific or locality specific air quality monitoring has been undertaken for this proposal, this monitoring data gives a general indication of the likely background levels in the study area.

Table 6-38 shows results for NO₂, CO and PM10 monitoring from the Office of Environment and Heritage monitoring sites. These levels have been presented in this report to show typical pollutant concentrations in the central coast region not measured directly on a busy road. This monitoring data gives an indication of the likely pollutant levels in the area around Ourimbah. Existing air quality impacts in the area are likely to be due to vehicle emissions from roads, and industrial facilities to the south of the study area.

Table 6-38 Summary of air quality monitoring at Wallsend/Newcastle

<table>
<thead>
<tr>
<th>Month &amp; Year</th>
<th>Carbon Monoxide ppm (1 hour)</th>
<th>Nitrogen Dioxide pphm (1 hour)</th>
<th>PM₁₀ (24 hour average) (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Newcastle</td>
<td>Wallsend</td>
<td>Newcastle</td>
</tr>
<tr>
<td>2007 January</td>
<td>0.1(0.3)</td>
<td>-</td>
<td>0.5(2.6)</td>
</tr>
<tr>
<td>2007 February</td>
<td>0.1(0.3)</td>
<td>-</td>
<td>0.4(2.1)</td>
</tr>
<tr>
<td>2007 March</td>
<td>0.1(0.4)</td>
<td>-</td>
<td>0.7(2.7)</td>
</tr>
<tr>
<td>2007 April</td>
<td>0.2(1.1)</td>
<td>-</td>
<td>0.8(2.5)</td>
</tr>
<tr>
<td>2007 May</td>
<td>0.3(1.7)</td>
<td>-</td>
<td>1.3(3.2)</td>
</tr>
<tr>
<td>2007 June</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2007 July</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2007 August</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2007 September</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2007 October</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2007 November</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2007 December</td>
<td>0.8(1.0)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Average</td>
<td>0.3</td>
<td>0.7</td>
<td>1.0</td>
</tr>
<tr>
<td>Goals</td>
<td>25ppm</td>
<td>12 pphm</td>
<td>50µg/m³</td>
</tr>
</tbody>
</table>

Note: - Data not available.

The monitoring results measured are well below NSW air quality objectives. Based on averaged data presented in Table 6-38, background air quality levels are assumed to be:

- 0.3 ppm carbon monoxide.
- 0.9 pphm nitrogen dioxide.
- 22 µg/m³ for particulates less than 10 micrometres (PM10).
6.9.3 Potential impacts

Construction

Dust generation would be the primary potential impact on air quality resulting from construction. The amount of dust would depend on the silt and moisture content of the soils and the type of activities being carried out. The major causes of dust would be:

- Clearing of vegetation and moving topsoil.
- Earthworks including embankments and cuttings.
- Milling and re-sheeting of the road pavement.
- Trenching for the installation of structures.
- General use of construction equipment and compound sites.
- Concrete cutting and/or demolition of the existing Cut Rock Creek bridge.

Dust mobilisation has the potential to create a visual impact, settle on property and residences and cause general discomfort for the community in the immediate area, as well as project personnel. These impacts are likely to be temporary and localised.

Exhaust from construction vehicles, plant and equipment would result in the emission of air pollutants which may affect health.

Operation

Table 6-39 and Table 6-40 present maximum total predicted pollutant ground level concentrations from TRAQ modelling at the closest receiver in each catchment for the years 2012 and 2022, respectively. These assume worst case weather conditions.

Based on a review of these results, it can be concluded that:

- Carbon monoxide levels around the study area are expected to be within the NSW air quality goal.
- Nitrogen dioxide levels around the study area are expected to be within the NSW air quality goal.
- PM10 levels around the study area are expected to be within the NSW air quality goal.

It should be noted that carbon monoxide pollutant ground level concentrations are predicted to decrease by 2022 even though vehicle numbers have increased. This is because vehicle emissions have been predicted to reduce as a result of cleaner running combustion engines and a newer vehicle fleet.

Pollutant ground level concentrations were specifically modelled for Nanna’s House Childcare Centre. While there are no specific air quality criteria for childcare centres, the modelling shows that carbon monoxide, nitrogen dioxide and PM10 ground level concentrations are expected to be well within the NSW air quality objectives.
<table>
<thead>
<tr>
<th>Location</th>
<th>Distance from curb (metres)</th>
<th>Carbon Monoxide (mg/m³) (1 hour average)</th>
<th>Carbon Monoxide (mg/m³) (8 hours average)</th>
<th>Nitrogen Dioxide (µg/m³) (1 hour average)</th>
<th>Nitrogen Dioxide (µg/m³) (annual)</th>
<th>Particulates &lt;10 PM10 (µg/m³) (24 hours)</th>
<th>Particulates &lt;10 PM10 (µg/m³) (annual)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Road</td>
<td>Total*</td>
<td>Road</td>
<td>Total*</td>
<td>Road</td>
<td>Total</td>
</tr>
<tr>
<td>W1</td>
<td>9</td>
<td>2.7</td>
<td>3.0</td>
<td>1.5</td>
<td>1.8</td>
<td>35.5</td>
<td>54</td>
</tr>
<tr>
<td>W2</td>
<td>26</td>
<td>1.3</td>
<td>1.6</td>
<td>0.9</td>
<td>1.2</td>
<td>26.1</td>
<td>44.6</td>
</tr>
<tr>
<td>W2-1 2 Childcare Centre</td>
<td>39</td>
<td>1.0</td>
<td>1.3</td>
<td>0.7</td>
<td>1.0</td>
<td>24.8</td>
<td>43.3</td>
</tr>
<tr>
<td>W3A</td>
<td>30</td>
<td>1.2</td>
<td>1.5</td>
<td>0.8</td>
<td>1.1</td>
<td>28.4</td>
<td>46.9</td>
</tr>
<tr>
<td>W3B</td>
<td>12</td>
<td>1.8</td>
<td>2.1</td>
<td>1.3</td>
<td>1.6</td>
<td>34</td>
<td>52.5</td>
</tr>
<tr>
<td>E1</td>
<td>11</td>
<td>1.9</td>
<td>2.2</td>
<td>1.3</td>
<td>1.6</td>
<td>34</td>
<td>52.5</td>
</tr>
<tr>
<td>E2</td>
<td>95</td>
<td>0.7</td>
<td>1.0</td>
<td>0.4</td>
<td>0.7</td>
<td>15</td>
<td>33.5</td>
</tr>
<tr>
<td>Criteria</td>
<td></td>
<td>30</td>
<td>10</td>
<td>246</td>
<td>62</td>
<td>50</td>
<td>30</td>
</tr>
</tbody>
</table>

* Includes background air quality concentrations.
<table>
<thead>
<tr>
<th>Location</th>
<th>Distance from curb (metres)</th>
<th>Carbon Monoxide (mg/m³) (1 hour average)</th>
<th>Carbon Monoxide (mg/m³) (8 hours average)</th>
<th>Nitrogen Dioxide (µg/m³) (1 hour average)</th>
<th>Nitrogen Dioxide (µg/m³) (annual)</th>
<th>Particulates &lt;10 PM10 (µg/m³) (24 hours)</th>
<th>Particulates &lt;10 PM10 (µg/m³) (annual)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>9</td>
<td>1.4</td>
<td>1.0</td>
<td>40.3</td>
<td>8.1</td>
<td>5.5</td>
<td>27.5</td>
</tr>
<tr>
<td>W2</td>
<td>26</td>
<td>0.9</td>
<td>0.65</td>
<td>34.9</td>
<td>7.0</td>
<td>3.4</td>
<td>25.4</td>
</tr>
<tr>
<td>W2-1 Childcare Centre</td>
<td>39</td>
<td>0.7</td>
<td>0.5</td>
<td>28.3</td>
<td>5.7</td>
<td>2.7</td>
<td>24.7</td>
</tr>
<tr>
<td>W3A</td>
<td>30</td>
<td>0.8</td>
<td>0.6</td>
<td>32.4</td>
<td>6.5</td>
<td>3.1</td>
<td>25.1</td>
</tr>
<tr>
<td>W3B</td>
<td>12</td>
<td>1.2</td>
<td>0.8</td>
<td>38.7</td>
<td>7.7</td>
<td>4.7</td>
<td>26.7</td>
</tr>
<tr>
<td>E1</td>
<td>11</td>
<td>1.25</td>
<td>0.9</td>
<td>38.7</td>
<td>7.7</td>
<td>4.8</td>
<td>26.8</td>
</tr>
<tr>
<td>E2</td>
<td>95</td>
<td>0.4</td>
<td>0.3</td>
<td>17.7</td>
<td>2.8</td>
<td>1.7</td>
<td>23.7</td>
</tr>
<tr>
<td>Criteria</td>
<td>30</td>
<td>10</td>
<td>246</td>
<td>62</td>
<td>50</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

* Includes background air quality concentrations.
6.9.4 Safeguards and management measures

Construction

A Construction Environmental Management Plan (CEMP) would be developed prior to construction and would include a soil & water management sub-plan. This would include the following safeguards to be implemented:

Dust

- Hardstands or similar would be provided in compound areas and work sites to reduce dust generation. Where possible, existing ground cover would be retained.
- Disturbed areas, stockpiles and handling areas would be maintained in a condition that minimises windblown, traffic-generated or equipment-generated dust. This would be done through activities including (but not limited to) watering, road sweeping and removal of accumulated material from environmental controls.
- Disturbed areas would be restored progressively, where possible, or at the completion of works.
- Where wind speeds reach a velocity that mobilises dust particulates, dust generating activities would cease and appropriate measures would be implemented to control dispersion.
- Dust deposition monitoring would be conducted at appropriate locations.
- The community would be informed of timing and reasons for works likely to generate high dust levels. A project hotline linked to the construction contractor would be available for complaints relating to construction.

Vehicle emissions

- Construction equipment and plant would be maintained in good working order.
- Equipment, plant and construction vehicles would be turned off when not in use.

Operation

No specific operational safeguards and management measures would be required. Operational impacts associated with air quality could be effectively managed through vehicle fuel standards, vehicle maintenance and emissions standards and testing, however this is outside the scope of this proposal and would be managed through broader government policies.

As per Section 6.9.3, it is predicted that cleaner running combustion engines and a newer vehicle fleet would reduce vehicle emissions.

6.10 Greenhouse gas emissions

6.10.1 Potential impacts

Construction of the proposal would produce greenhouse gas emissions (‘carbon emissions’) associated with the extraction and manufacture of construction materials, transport of materials to site, on-site fuel use and loss of biomass due to vegetation clearance.

Table 6-41 summarises primary emissions sources and opportunities to reduce emissions.
Table 6-41 Construction phase carbon sources and opportunities

<table>
<thead>
<tr>
<th>Construction Emission Sources</th>
<th>Scope for Carbon Reduction Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-site Fuel Use</td>
<td>Moderate</td>
</tr>
<tr>
<td>Pavement Materials (Permanent)</td>
<td>High</td>
</tr>
<tr>
<td>Other Materials and Products</td>
<td>High</td>
</tr>
<tr>
<td>Vegetation Clearance</td>
<td>Moderate</td>
</tr>
<tr>
<td>Pavement Materials (Temporary)</td>
<td>High</td>
</tr>
<tr>
<td>Transport Fuel Use – Deliveries to Site</td>
<td>Low</td>
</tr>
<tr>
<td>Electricity Consumption</td>
<td>Moderate</td>
</tr>
<tr>
<td>Transport Fuel Use – Removal of Materials from Site</td>
<td>Low</td>
</tr>
</tbody>
</table>

Emissions from operation of the proposed road upgrade would include direct emissions related to the maintenance of the road and indirect emissions from the use of the road by vehicles.

6.10.2 Safeguards and management measures

Table 6-42 outlines carbon abatement opportunities to be adopted where possible during detailed design and construction phases. While much of the construction-phase emissions are fixed and unavoidable due to material use and transport requirements, there are a number of carbon reduction opportunities.

The RTA’s Climate Change Plan (RTA, 2009a) specifies a process for achieving carbon neutrality is to avoid - reduce - offset. Table 6-42 identifies measures to avoid emissions, and where it cannot be avoided, minimising the energy needed for construction activities and maximise the use of low carbon energy.

There would be minimal opportunities to reduce operational carbon emissions from the proposal.

Table 6-42 Carbon emissions reduction opportunities

<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Carbon Reduction Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetation Clearance</td>
<td>Minimise vegetation clearance.</td>
</tr>
<tr>
<td></td>
<td>Maximise scope for on-site or local reuse of cleared vegetation (such as mulch or roadside habitat).</td>
</tr>
<tr>
<td>On-Site Fuel Use</td>
<td>Avoid double-handling of materials via temporary stockpiles.</td>
</tr>
<tr>
<td></td>
<td>Minimise cut and fill activities.</td>
</tr>
<tr>
<td></td>
<td>Minimise use of temporary pavements/structures. Temporary pavements would be heavy duty and resource-intensive with a high carbon penalty per m².</td>
</tr>
<tr>
<td></td>
<td>Maximise reuse of existing and temporary pavements to reduce the need to import materials for permanent pavements/structures.</td>
</tr>
<tr>
<td>Transport Fuel Use – Deliveries to Site</td>
<td>Minimise import of materials for use in selected material zone and for use as general fill by utilising existing site materials, improved by stabilisation if required.</td>
</tr>
<tr>
<td>Transport Fuel Use – Removal of Materials from Site</td>
<td>Utilise existing materials (such as existing pavements or known/potential unsuitable materials) on site where possible.</td>
</tr>
<tr>
<td>Pavement Materials</td>
<td>Minimise the use of cement and steel within the project where feasible. Both</td>
</tr>
</tbody>
</table>
Project Activity | Carbon Reduction Opportunities
--- | ---
materials are very greenhouse intensive. Making provision within designs for use of partial cement substitutes (such as fly ash and ground granulated blast furnace slags) and recycled materials may lead to substantial carbon emission reductions. Minimise the use of temporary pavement materials.
Other Materials | Avoid over specification of material quantities and properties (eg lower-strength concrete applications such as kerb and guttering provide good opportunities to reduce carbon emissions and demand on natural resources through use of recycled materials).
Minimise use of temporary structures. Identify opportunities to reduce cement, steel and aluminium use within the proposal in favour of lower emission materials.

6.11 Geology and soils

6.11.1 Existing environment

Geology and soils

The 1:100,000 Geological Series Sheet for Gosford – Lake Macquarie shows that the local area surrounding the proposal is underlain by recent alluvial sediments of the Bangalow Creek valley, overlying rocks of the Terrigal Formation. These rocks are shown to comprise sandstone, siltstone, minor sedimentary breccia, claystone and conglomerate. Investigations (RTA, 2009) at the study area encountered alluvial deposits, sandstone and siltstone within the study area.

The Gosford - Lake Macquarie 1:100,000 soil landscape sheet shows that the road corridor is situated in both Erina and Yarramalong soil landscapes.

Erina soil landscapes are characterised by undulating to rolling rises and low hills on the Terrigal Formation. The soils are considered moderately deep to deep yellow earths. Soils in this landscape often have low available water capacity, may be highly acidic, and can have high erosion hazard and localised foundation hazard.

Yarramalong soil landscapes are often characterised by level to gently undulating alluvial plains on Quaternary sediments in the Watagan Mountains and Erina Hills. The soils are often deep alluvial soils including yellow and red earths. Soils in this landscape often have low available water capacity, low fertility and may be highly acidic, and are subject to water logging and stream bank erosion.

Geotechnical investigations at the study area by Golder Associates (Golder Associates, 2009) identified the following soil and rock conditions:

- Topsoil typically 0.2 to 0.4 m thick dark brown sandy silt with low plasticity was found in most borehole and test pit locations, but not all. The topsoil would not be suitable as engineering fill, but could be used for landscaping works.
- Fill typically sandy gravel or gravelly sand and silty sand up to 2.5m thick, which make up the embankments for the current Pacific Highway.
- Alluvial floodplain soils which vary considerably in consistency and depth, with soils being a mix of sand, silt and clay.
- Rock derived units comprising residual soil and weathered sandstone and siltstone that have weathered in-situ from the underlying sandstone and siltstone. Residual soil typically had a depth of less than 5m.

There are no steep slopes exceeding 20 per cent, apart from short embankment slopes for the current road fill. The Mine Subsidence Board has advised that the area is not within a proclaimed Mine Subsidence District, and is therefore not subject to any building restrictions imposed by the Board.

**Acid Sulfate Soil (ASS)**

Acid Sulfate Soil risk maps from the CSIRO’s *Australian Soil Resource Information System* (accessed online) indicate that there is an extremely low risk of ASS within the study area.

Acid sulfate soil testing was carried out during geotechnical investigations undertaken for the proposal (Golder Associates, 2009). This involved field screening of 25 samples taken at 13 boreholes or test pits, to determine the potential presence of acid sulphate soils. Most samples showed a low to moderate potential for acid sulfate soils. Generally, deeper samples showed higher potential for acid sulfate soil.

Samples that showed positive results were then tested using the SPOCAS (Suspension Peroxide Oxidation Combined Acidity and Sulphate) suite for a more rigorous assessment of oxidation potential, as well as to determine requirements for neutralisation of the soils. The results of testing were classified in accordance with the Acid Sulfate Soil Assessment Guideline (ASSMAC, 1998). Two of the samples exceeded the guideline criteria:

- BH324 at 2.5m depth, midway between Teralba Street and Cut Rock Creek north.
- BH347 at 2.0m depth, under the existing highway adjacent to Lisarow Cemetery.

The SPOCAS results indicated generally low potential for acid sulfate soil risks associated with the excavation works. This is reflected in generally low oxidisable sulfur values, and low rates of lime required for neutralisation of potential acidity.

It is possible that limited acid sulfate soils in alluvial sediments exist below the water table.

**Contaminated soil**

An environmental site assessment was carried out to investigate the potential for contaminated land within the proposal corridor due to historical activities, identify the presence of contaminated soil or groundwater that may potentially cause environmental or human health risks, and provide recommendations for management of any contamination identified. Testing was carried out during geotechnical investigations undertaken for the proposal (Golder Associates, 2009). The Contaminated Land and Groundwater Assessment is attached to this REF as Appendix H.

The assessment revealed that no properties adjacent to or in close proximity to the works are registered with Office of Environment and Heritage (formerly Department of Environment, Climate Change and Water) as known contaminated sites. However, some existing or former properties such as service stations or market gardens may have been involved in potentially contaminating activities.

The Environmental Site Assessment indicated that:

- Historically the area was predominately rural - used for farming such as market gardens and orchards. From the early 1970s, the area was progressively developed for a combination of residential and commercial/industrial land uses. A service station was established along the northern part of the corridor in 1975.

- Anecdotal information indicated that another service station may have historically existed between Robert Holl Drive and Cut Rock Creek on the western side of the highway.
Field investigations encountered fill material at most locations, to depths of greater than three metres. The fill material primarily comprised silty sands, with higher gravel and clay content observed at some locations. The fill material is thought to comprise local re-worked soils.

Natural soils encountered comprised alluvial and residual sediments including a range of predominantly loose sands and gravels, with silts and clays of low plasticity. Weathered claystone and sandstone was encountered at four locations at depths of between 7.8m and 19.0m below ground surface.

The results of soil testing indicated elevated concentrations of petroleum hydrocarbons (TPH C10-C36 and PAH) at various locations along the road corridor, including the existing service station site. These elevated TPH and PAH concentrations exceed the NEPM EIL, NEPM E or NEPM F Health Investigation Levels.

The investigation did not indicate the presence of petroleum hydrocarbons at the estimated location of the former service station site.

Soils in the vicinity of the corner of Teralba Street and Pacific Highway (BH321), southern end of Lions Park (BH336), opposite the service station (TP342) and opposite Lions Park (BH348) exceeded the restricted solid waste classification (CT2).

The investigation did not indicate that contamination levels present a significant risk of harm to human health or the environment, if they remain undisturbed.

6.11.2 Potential impacts

Erosion and sediment control

Due to the high erosion hazard associated with soil types present in the study area, there is a risk of erosion and scouring arising from construction works, and the removal of vegetation during the site clearance works. Works within and adjacent to Cut Rock Creek (north and south) may also result in sedimentation of this waterway.

Acid Sulfate Soil

Disturbance of acid sulfate soils is expected to be minimal, and therefore potential risks associated with exposing acid sulphate soils during excavation are generally low. The potential disturbance and likelihood of disturbance to acid sulfate soils is described in Table 6-43 below.

<table>
<thead>
<tr>
<th>Location</th>
<th>Scope of Potential Disturbance</th>
<th>Potential to Disturb Acid Sulfate Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut Rock Creek Bridge</td>
<td>Excavation for bridge foundations</td>
<td>Possible, excavation at depths of acid sulfate soils.</td>
</tr>
<tr>
<td>Between Teralba Street and Cut Rock Creek Bridge</td>
<td>Excavation of road embankment and verge to place select materials.</td>
<td>Unlikely, no excavation to depths of acid sulfate soils.</td>
</tr>
<tr>
<td>Lisarow Cemetery</td>
<td>Excavation of road embankment and verge to place select materials.</td>
<td>Unlikely, no excavation to depths of acid sulfate soils.</td>
</tr>
<tr>
<td>Utility adjustments</td>
<td>Excavation of soil for utility adjustments</td>
<td>Possible, excavation at depths of acid sulfate soils.</td>
</tr>
</tbody>
</table>

The scope of disturbance of acid sulfate soils is dependent on construction methods selected for the bridge foundations and utility adjustments.
Contaminated soil

Disturbance to some potentially contaminated locations is expected to occur, although potential risks associated with exposing contaminated soils during excavation are generally low. Potential scope and likelihood of disturbance to contaminated areas is described in Table 6-44 below.

Table 6-44 Scope of disturbance to contaminated areas

<table>
<thead>
<tr>
<th>Location</th>
<th>Scope of Potential Disturbance</th>
<th>Potential to Disturb Contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating service station</td>
<td>Excavation of road embankment and verge to place select materials.</td>
<td>Possible, from excavation of soil for utilities and tie-in with Stage 2.</td>
</tr>
<tr>
<td>Near Teralba Street</td>
<td>Excavation of road embankment and verge to place select materials.</td>
<td>Unlikely, no excavation to depths of contamination.</td>
</tr>
<tr>
<td>Lisarow Cemetery</td>
<td>Excavation of road embankment and verge to place select materials.</td>
<td>Likely, from excavation of soil at tie-in with Stage 3B.</td>
</tr>
<tr>
<td>Utility adjustments</td>
<td>Excavation of soil for utility relocations</td>
<td>Possible, excavation at depths of contamination.</td>
</tr>
</tbody>
</table>

Further information on contamination identified is available in the Contaminated Land and Groundwater Assessment in Appendix H of this REF.

6.11.3 Safeguards and management measures

Erosion and sediment control

A Construction Environmental Management Plan (CEMP) would be developed prior to construction and would include a soil & water management sub-plan. This plan would be based on the guidelines Managing Urban Stormwater: Soils and Construction (Landcom, 2004) and Managing Urban Stormwater: Volume 2D Main Road Construction (DECCW, 2008). All work would be carried out to avoid or minimise erosion of the site and the surrounding areas. Erosion and sediment control measures include:

- Minimise the area of land disturbed by construction.
- Clean water diversions would be installed to divert any off-site water around the site.
- Divert stormwater around disturbed areas to sealed or stabilised areas. Where this is not possible, convey stormwater across disturbed areas within a stabilised flow path.
- Dust suppression techniques would be implemented to minimise dust. This may include dampening of exposed soils and stockpiles.
- Dust generating works would not occur in high winds or weather events that may exacerbate the generation of dust.
- Soil and erosion controls would be established prior to any land clearing being undertaken.
- Land clearing activities would not be undertaken when large rainfall events are predicted.
- Traffic movements in the construction zone would be minimised to limit dust disturbance.
- Soil from vehicle wheels and undercarriages would be removed prior to exit from disturbed areas.
- Disturbed surfaces would be compacted at the end of each work day to reduce erosion potential. Any material transported onto pavement surfaces would be swept and removed throughout the day.
A qualified soil conservationist would be engaged to inspect earthworks and drainage activities at appropriate intervals throughout the construction phase.

Stockpile sites would be located at least 40 metres away from any waterways.

Ensure that any imported topsoil complies with RTA QA Specification R178 - Vegetation.

Disturbed surfaces would be re-vegetated as soon as practical to prevent extended exposure to erosion.

Batters would be stabilised with geotextile fabrics, local native grasses and/or local native shrubs were needed, as soon as practical.

Disturbed areas would be progressively rehabilitated as construction is completed.

Regular inspections of erosion and sediment would occur after rain and during periods of prolonged rainfall.

Erosion and sediment control measures would apply to all areas which may be disturbed. Further measures to prevent soil erosion and sedimentation and to protect water quality are outlined in Section 6.8.3.

**Acid sulfate soil**

- During detailed design, utility adjustments would be designed to minimise contact with areas and soil depths likely to contain acid sulfate soils.

- An acid sulfate soil management sub-plan would be included as part of the Construction Environmental Management Plan (CEMP) developed prior to construction.

- Where disturbance of acid sulfate soils causes’ oxidisation, the excavated spoil suspected to contain acid sulphate soils would be set aside from other spoil for testing. Based on test results, acid sulfate soils would be treated with lime as per SPOCAS test recommendations and reused on-site, or disposed of off-site.

- Acid sulfate soils would be managed in accordance with the RTA Guidelines for the Management of Acid Sulphate Materials: Acid Sulfate Soils, Acid Sulfate Rocks and Monosulfidic Black Ooze (2005).

**Contaminated soil**

During detailed design construction activities would avoid excavation of areas of potential soil contamination detected at the identified locations (BH321, BH336, TP342 and BH348).

A contamination management sub-plan would be included as part of the Construction Environmental Management Plan (CEMP) developed prior to construction. This would include:

- During excavation and relocation of underground services an inspection for potential presence of asbestos would be undertaken on all pipe work.

- All excavated contaminated spoil to be disposed of off-site would be analysed for classification according to the Office of Environment and Heritage (formerly Department of Environment, Climate Change and Water) Waste Classification Guidelines (DECCW 2009) and transported to an appropriate disposal facility.

- If dewatering or deep excavations below groundwater levels are required, further investigations would be required to determine the nature and extent of contamination and to determine its impact on the proposed construction works.

- If contaminated soils or groundwater would be disturbed requiring remediation, a Contaminated Soils Remedial Action Plan would be prepared.

- The results of the contamination assessment would be incorporated into an Occupational Health & Safety Plan to ensure the health and safety of construction workers and the general public is appropriately managed.
6.12 Waste and resources

6.12.1 Potential impacts

The proposal has the potential to generate various types of waste that can be reused or recycled, in accordance with the principles of the Waste Avoidance and Resource Recovery Act 2001, and some wastes that would require disposal. Wastes likely to be generated during construction would include:

- Bitumen, concrete and asphalt from removal of existing pavements.
- Coal tar material is known to be present within the existing pavement.
- Asphalt from existing pavements that contains coal tar – coal tar above 1 per cent by weight is pre-classified as hazardous waste in the Office of Environment and Heritage (formerly Department of Environment, Climate Change and Water) Waste Classification Guidelines (DECCW 2009).
- Excess fill material that cannot be reused on site.
- Demolition waste from removal of existing structures.
- Green waste from vegetation clearance.
- Oil, grease and other liquid wastes from construction plant and equipment.
- Domestic and construction wastes and sewage from site offices and compounds.

There may be some disturbance of contaminated soils during construction. Further information and assessment is provided in Section 6.13 of this REF.

It is anticipated that there would be a deficit of spoil from earthworks during construction. This is partly because cut volumes would be lower than fill volumes required, and because some material would be unsuitable for use and would need replacing. Around 28,000m³ of imported fill material would be required, while around 20,000m³ of unsuitable materials would need to be removed from the site.

In addition, the proposal would require around 12,500m³ of selected material for use in the upper sections of the road formation, for which material of a specified higher quality is required. It is anticipated that the selected materials would be imported and would be sourced from a local, licensed supplier where possible.

The estimated quantities of materials for import, re-use and waste/disposal would be further refined and quantified during detailed design, and would be subject to the construction methodology adopted by the construction contractor.

Office facilities, lunch room facilities and work personnel would produce general waste such as paper, plastics, food and beverage wrappers etc.

Resources used for the construction of the proposal would include the use of potable water.

6.12.2 Safeguards and management measures

A Construction Environment Management Plan would be developed prior to construction and would include a waste management sub-plan. This plan would include the following measures:

- Utilise recycled content materials and products with recycled content wherever these would be cost and performance-competitive, and where they are at least the environmental equivalent of non-recycled alternatives.
- Topsoil and vegetation removed during site clearance and earthworks would be reused on site where feasible.
- Recycle and reuse concrete or asphalt removed in areas of fill or landscaping if practical.
- Minimise disturbance of asphalt containing coal tar during detailed design by paving over the top of the existing pavement, reducing hazardous coal tar waste generated. Any coal tar requiring removal would be handled following appropriate guidelines and disposed of offsite at an appropriate facility.
- Dispose of excess spoil in accordance with Office of Environment and Heritage (formerly Department of Environment, Climate Change and Water) *Waste Classification Guidelines* (2009).
- Maintain a waste register detailing types of waste collected, amounts, date/time and details of disposal. Collect waste transport and disposal receipts to ensure waste is being transported to authorised facilities.
- Recycle used oils and greases, or dispose at an appropriately licensed facility.
- Source any imported fill from licensed/registered suppliers within the local area.
- Separate waste according to type and store in temporary containers within the site compound for removal at regular intervals for reuse, recycling or disposal.
- Waste and recycling facilities would be provided for staff and office waste.
- The Australian Standard AS2601: The demolition of structures would be followed for the demolition of the existing bridge structure.

Prior to the demolition of any structures, an inspection would occur to assess the potential for the presence of asbestos or other hazardous materials. If hazardous materials are found on site, measures to protect the health of workers and the general community would be developed.

In order to reduce potable water consumption, alternate sources of water would be investigated including using treated water collected in sediment basins.
7 Environmental management

7.1 Environmental Management Plans

A Construction Environmental Management Plan (CEMP) and additional sub-plans would be developed in accordance with the specifications set out in:


The CEMP would incorporate additional site-specific requirements, outlined below, which are not covered by specifications. The CEMP would be reviewed and certified by an RTA Environmental Advisor, Central Coast Region, prior to the commencement of any construction works.

Implementation of actions in the CEMP would be audited by RTA representatives at regular intervals. Any corrective action requests arising from audits would be followed up through re-inspection to ensure adequate actions are undertaken.

7.2 Summary of safeguards and management measures

Environmental mitigation measures outlined in Table 7-45 below would minimise the identified impacts of the proposal on the environment. The measures described, and any additional measures specified in the RTA’s Decision Report, would be incorporated into the CEMP.

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Management Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecology</td>
<td>Flora and fauna controls would be undertaken in accordance with the RTA G40 Clearing and Grubbing specifications, sections 6.9 and 6.10 of the RTA G36 Environment Protection (Management Plan) and the RTA Draft Biodiversity Guidelines - Protecting and Managing Biodiversity During Road Projects and Maintenance (2011).</td>
</tr>
<tr>
<td>Construction</td>
<td>Melaleuca biconvexa would be incorporated as a key landscape element in suitable habitat, where possible</td>
</tr>
<tr>
<td></td>
<td>Impacts to and clearing of M. biconvexa would be minimised where feasible and reasonable. The use of retaining walls adjacent to the proposed highway alignment would be considered during detailed design.</td>
</tr>
<tr>
<td></td>
<td>Black Sheoak (Allocasuarina littoralis) would be incorporated into the landscaping plans to improve foraging habitat for Gang Gang Cockatoo, Grey-headed Flying-fox and Glossy-black Cockatoo in the local area.</td>
</tr>
<tr>
<td></td>
<td>Investigate the potential for constructing suitable roosting structures for bats at favourable locations adjacent to the proposal.</td>
</tr>
<tr>
<td></td>
<td>Locally endemic species would be used as part of the landscaping plans for the proposal. Exotic species would not be included in the plan.</td>
</tr>
<tr>
<td></td>
<td>The Department of Primary Industries (Fisheries) (formerly NSW Industry and Investment) guidelines ‘Why do fish need to cross the road? – Fish passage requirements for waterway crossings’ would be used when designing all structures within or adjacent to Cut Rock Creek. This would include maintaining fish passage, replicating the natural sandy/gravel stream bed conditions and maximising light penetration within the culverts.</td>
</tr>
</tbody>
</table>

A Construction Environmental Management Plan (CEMP) would be developed prior to construction and would include a flora and fauna management sub-plan. This plan would include the following:
Potential Impact | Management Measure
--- | ---
Clearing of native vegetation would be minimised where feasible and reasonable during construction. Areas not to be cleared would be well delineated by temporary fencing or flagging throughout construction. | 
Construction equipment would utilise existing tracks and paths to access each the culvert and bridge construction areas. | 
Weed species within the study area would be removed and controlled from spreading where feasible and reasonable. | 
Noxious weeds within the proposal area as identified in section 6.1.2 of this REF would be managed in accordance with the Noxious Weeds Act 1993 and local council control plans. | 
Melaleuca biconvexa seeds would be collected from local species prior to construction and used for future propagation of the species in the landscaping of the proposal. | 
The area of Sydney Freshwater Wetlands EEC between Robert Holl Drive and the Pacific Highway, identified in section 6.1.2, would be identified by a qualified ecologist on site and clearly delineated by temporary fencing or flagging throughout construction to prevent any impacts to the area. | 
Clearing of vegetation would be undertaken progressively and inspection of any potential habitat (including nests in shrubbery or trees or holes in the ground) would be undertaken prior to clearing. | 
The existing Cut Rock Creek bridges and culverts would be inspected by a qualified ecologist for bat species presence prior to demolition and construction. If present a plan to relocate and provide alternative habitats would be developed by a suitable ecologist and agreed to by the regional Environmental Officer. | 
A qualified ecologist would check for the potential presence of platypus at the Cut Rock Creek crossings prior to construction at those locations. If detected, further advice would be sought from RTA environment staff prior to any works commencing. | 
Qualified ecologists and/or bush regenerators would be used for all regeneration works. | 
Fish passage in the creek would be maintained at all times throughout construction of the culverts, bridges, weirs and levees. | 
Provisions would be installed during demolition and construction of the bridges to minimise pollution, including sediment or pieces of bridge structure, falling into the creek. | 
No construction equipment would be placed within the wet creek bed. Equipment may be used on dry creek beds, with appropriate erosion and sediment controls to minimise impacts within and adjacent to the creek, where the waterway has been diverted. | 
The Wildlife Information Rescue and Education Service (WIRES) would be contacted if any injured native fauna are found throughout demolition or construction. | 
Potential habitat components such as mature trees, fallen logs, loose bark and rocks within the proposal area would be retained and/or relocated and used as landscape features wherever possible within the study area. | 
All clearing, bush regeneration and landscaping work would be undertaken in accordance with the (former) NSW Industry and Investment ‘Guidelines for preventing spread of Myrtle Rust in bushland’ (Industry and Investment, 2010). | 
All construction workers would undertake inductions to inform them of sensitive ecological areas and the construction methods and safeguards to protect that environment. |

**Operation**
The weir and fish access point would be maintained to ensure that fish passage is provided at all times.

**Noise & vibration**
**Construction**
During detailed design of the proposal, examine feasible and reasonable noise mitigation measures where noise management levels identified in this REF are exceeded.

**A Construction Environmental Management Plan (CEMP) would be developed prior to construction**
and would include a construction noise and vibration management sub-plan. This plan would include the following measures:

- Establish a publicly available hotline for noise and vibration issues for the proposal.
- Identify a staff member who is the primary contact person responsible for responding to and following-up issues raised by the local community.
- Develop a procedure for how to actively respond to noise and vibration issues.
- Construction activities would be between 7am - 6pm Mondays to Fridays, and 8am - 1pm Saturdays. No works would be undertaken on Sundays or public holidays.
- Should any works be required outside the above standard working hours, such as night works, the procedures in the RTA’s Environmental Noise Management Manual 2001 ‘Practice Note vii – Roadwork’s outside of normal working hours’ would be followed.
- Provide induction training and awareness to construction staff in relation to approved working hours, noise and vibration mitigation measures, minimising equipment noise and switching equipment off when not in use.
- Vibration monitoring would be undertaken at the commencement of vibration-generating activities such as piling or rock hammering, to establish the minimum working distances to nearby vibration sensitive receivers.
- Vibration monitoring would be undertaken when operating a vibratory roller within 30m of a building, to assess compliance with structural or comfort criteria.
- Plant, storage facilities or other ancillary facilities would be located away from sensitive receivers where possible.
- Equipment would be switched off when not in use.
- Construction programming would minimise the use of multiple noise producing equipment at the same time where possible.
- All equipment on site would be maintained in a good working order and properly serviced. All vehicles would be fitted with the appropriate mufflers and the use of exhaust breaks would be limited, where possible.
- Where feasible and reasonable a combination of any of the following noise mitigation measures would be used to minimise construction noise impacts at adjacent sensitive receivers:
  - Temporary noise walls/barriers.
  - Respite periods during high noise activities, such as driven piling and rock breaking.
  - Use of dampening tips on rock breakers.
  - Using spotters, closed circuit television monitors, ‘smart’ reversing alarms, or ‘squawker’ type reversing alarms in place of traditional reversing alarms.
  - Selecting plant and equipment based on noise emission levels.

**Operation**

Noise mitigation would be implemented for residential receivers where base criteria, allowance criteria and/or acute noise levels are exceeded. This would be determined during detailed design based on the final plans for the proposal. Potential noise safeguards and management measures include:

- Low noise road pavement - noise reduction from using open graded asphalt paving would be less than 2 dBA. However, open graded asphalt has a limited life with respect to wear and noise reduction, therefore may not be practical for this proposal.
- Roadside noise barriers - A noise barrier may be effective at reducing noise levels for residences from 28 to 38 Robert Holl Drive. A feasible and reasonable assessment would be completed during detailed design to determine if this can make up part of the proposal. This barrier would potentially be around 3.5 metres high and run along the back of those...
Potential Impact | Management Measure
---|---
properties. If the barrier is not feasible and/or reasonable, other mitigation measures described below would be considered.
- Architectural treatment of exposed residences - architectural treatment of residences would depend on the level of exceedance over the noise criteria. Typically the level of treatment is:
  - 1-10 dBA exceedance - offer fresh air ventilation, sealing of wall vents and check window and door seals and replace where necessary.
  - >10 dBA exceedance - offer fresh air ventilation, sealing of wall vents and check window and door seals and replace where necessary. Offer to upgrade glazing and doors where residences are in a suitable condition and material.
- Predicted noise levels in the study area (noise catchments) are all in the first category. Architectural treatment is likely to provide the best method of noise management for this proposal. The use of architectural treatment would be considered in the feasible and reasonable assessment for the proposed noise mitigation of the proposal along with the potential noise barrier outlined above.

| Socio-economic | Property |
---|---
If the RTA determines to proceed with the proposal, owners of properties directly affected would be contacted, and receive notification from the RTA of its intention to purchase all or part of the property. Property acquisition would be in accordance with the provisions of the *Land Acquisition (Just Terms Compensation) Act 1991*. The RTA Land Acquisition Information Guide (2011) details the procedures and process to be followed in the acquisition process and a copy is provided in Appendix C.
All residents at properties affected by disruptions to utilities such as water, gas, phone and power as part of the proposal would be given at least five days notice of any disruption to services, or as required by the relevant authority.

**Accessibility**
Consultation would be undertaken with residents and business owners where their access is impacted by the proposal. Such consultation would be undertaken prior to the commencement of works and would be undertaken in accordance with the *RTA’s Community Involvement and Communications Manual* (2008).
Where temporary access is modified during construction, impacted residents, businesses and community facilities would be notified at least five days prior in order to minimise disruption to access. Where access is affected, the RTA would maintain reasonable access to all properties in negotiation with respective land owners and businesses.
Notices relating to roadworks and changed traffic conditions would be advertised in local newspapers and letterbox drops at least five days prior to the change.
Relevant emergency services, including fire, ambulance and police, would also be consulted to ensure that safe access is maintained during the construction period in the event of an emergency.
As part of the Community Consultation Strategy communication activities during construction would include, but would not be limited to, door knocks, newsletters or letterbox drops providing information on the proposed works, working hours to be adhered to and a contact name and number for complaints. These details would be included as part of the Construction Environmental Management Plan (CEMP).
A comprehensive signage scheme for pedestrians and cyclists would be developed to maintain a sense of connectivity across the highway and to encourage safe pedestrian activity.
Provision would be made for pedestrians and cyclists to detour around the construction site safely at all times and temporary bus stops would be provided where necessary.
A Traffic Management Plan including these details would be prepared and implemented to manage traffic during construction.

**Local business**

### Potential Impact Management Measure

Access to all business operations and properties would be maintained during construction.

Access to the Tall Timbers Hotel parking facilities would be maintained at all times.

The construction of the proposal would provide positive temporary economic benefits by providing employment opportunities and business for suppliers in the local region. An increase in construction stuff throughout construction would potentially increase revenue at local businesses especially lunch facilities.

‘No parking’ signs would be erected where relevant to notify the changes in informal parking arrangements.

### Amenity

A Construction Environmental Management Plan (CEMP) would be prepared for the proposal, which would incorporate all environmental safeguards and mitigation measures to be implemented during construction. This would include hours of work, minimising air, noise, dust, amenity and access impacts on the surrounding community.

A site-specific Construction Noise and Vibration Management Sub-plan, and Dust & Air Quality Management Sub-plan would be prepared and implemented by the construction contractor.

Community communications activities would be used during construction to keep the community informed of timing / reasons for any works likely to cause a disturbance. A project hotline linked to the construction contractor would also be available for any complaints relating to construction.

The potential changes to the semi-rural perception of the local area would be mitigated through the landscape and urban design strategy, which minimises the visual impact of the upgraded highway, and seeks to maintain the characteristic plantings and trees of the existing area.

### Traffic Construction

A Construction Environmental Management Plan (CEMP) would be developed prior to construction and would include a construction traffic management sub-plan. This plan would include the following:

- The local community would be informed of changed traffic conditions and any likely access disruptions.
- Measures to reduce use of back routes throughout construction would be implemented.
- Community information sessions would be held if and when required.
- An information hotline and a complaints register would be established for the pre-construction and construction phases to address community issues and provide updates on project status.
- A minimum of one traffic lane would be available at all times during construction.
- Traffic management measures would be established to keep road users informed, including the use of temporary speed limits, line marking, warning signs, traffic control and temporary barriers and markings.
- Safe access for pedestrians and cyclists around work areas would be provided at all times.
- A thoroughfare for emergency vehicles would be provided at all times.
- Access to private properties would be provided at all times. Residents would be notified if works are likely to cause delays in accessing their properties.
- Access to temporary bus stops would be provided as close as possible to the location of existing bus stops.

Works that would be disruptive to traffic flows would be undertaken outside of peak hours where possible.

### Operation

- Local residents and the general community would be informed about changed access arrangements at the beginning of operation of the new road.
**Potential Impact**  
**Management Measure**

- At opening of the proposal monitoring of the new traffic signal intersections would be undertaken to ensure that the sequencing and timing of the lights appropriately manages traffic accessing the Pacific Highway after opening of the proposal without extensive delays.

**Landscape, visual, Visual urban design**

The following measures would be implemented to minimise impacts to landscape character:

- Landscaping made up of indigenous species, including large tree species would be established along the road corridor. These would help to complement the existing natural environment and re-introduce a tree canopy to soften the impact of road.
- Road shoulders would be softened, within road safety guidelines, using vegetation throughout the proposal to aid a water sustainable design and to reinforce the semi-rural nature of the area.
- Concrete kerbing would generally be used at the new intersections and their approaches, where the shared path abuts the road corridor, and in Ourimbah.
- If roadside noise barriers are required, the barrier would be developed with the appropriate height, structure and finishes to be sympathetic to the surrounding environment.

**Landscape**

The following measures would be implemented to minimise impacts to visual amenity:

- Batters would be designed to a minimum ratio of 1 in 3 to aid revegetation of the area where feasible and reasonable.
- Removal of endangered or large mature trees would be minimised by installing retaining walls to reduce the construction footprint where feasible and reasonable.
- Aesthetic and landscape treatments to any potential noise barriers would be of equivalent quality to both sides.
- Medians would be vegetated, where possible and within road safety guidelines, to break down the scale of the road and lessen the impact of the road widening, reinforcing the sense of a ‘green corridor’.
- The shared path would be separated from the edge of the road by a minimum 1.5 metre planted verge where possible and within road safety guidelines. This would reinforce the green corridor and provide a visual and physical break to a continuous paved surface.
- Overhead low voltage power lines would be relocated underground, to reduce visual clutter and allow for new landscape treatments.

**Aboriginal heritage**

- In the event that any Aboriginal objects are uncovered during construction, works would cease immediately within the vicinity of the find and guidance would be sought from the regional RTA Aboriginal Cultural Heritage Advisor.
- As part of the site induction, construction personnel would be notified of the requirement to stop works and notify supervisors if any unknown items are found during construction.

**Non- Aboriginal heritage**  
**Lisarow Cemetery**

- An archaeological test excavation would be conducted in the area between the eastern property boundary of the cemetery and the Pacific Highway prior to construction to determine the likelihood of unmarked graves. The work would be carried out by a suitably qualified archaeologist under an Exception Permit granted by the Office of Environment and Heritage under s139(4) of the Heritage Act 1977.
- If unmarked graves are located within this area, works in this area would cease immediately and further consultation with the Office of Environment and Heritage, the Department of Health and the local police would be undertaken.
Potential Impact Management Measure

- Protective measures would be established around the stone and metal gates during construction in this area.
- Construction workers would undertake an induction on the heritage value of these gates, the potential for unmarked graves and the general sensitivity of the cemetery area during construction.

Unknown Items

In the event that unknown non-Aboriginal archaeological items are uncovered during the excavation/construction phase, all works would stop in the immediate vicinity of the item and the RTA Environmental Officer and the Office of Environment and Heritage would be notified of the discovery.

Hydrology and water quality Detailed Design

Appropriate best practice techniques from the following documents would be used during design development, including:


In addition:

- Reinforced earth retaining walls would be used where feasible and reasonable to limit embankment construction and potential erosion.
- Clearing riparian vegetation and disturbing creek banks would be minimised to accommodate stormwater management infrastructure.

Operation - Stormwater

During detailed design measures would be incorporated into the proposal to slow roadside surface flows as well as retaining road runoff pollutants during operation of the road. Features to be further developed during detailed design include:

- Vegetated swales, verges and table drains located on both sides of the highway between Cut Rock Creek culvert and Teralba Street, between Teralba Street and Cut Rock Creek Bridge and north-east of Cut Rock Creek bridge. This would reduce kerb and gutter and piped drainage systems, improving water quality and aligning with water sensitive urban design principles.
- Incorporation of median swales and soft landscaping treatments.
- Gross pollutant traps (GPTs) potentially located at low points prior to outlets to small water courses or small vegetated wetlands. GPTs would be proprietary systems such as Continuous Deflective Separation (CDS) units or an approved equivalent.

The RTA’s Water Policy (1997) would be used to ensure the operational impacts of the proposal are designed to:

- Retain existing natural overland flows and the groundwater regimes.
- Maintain existing surface and groundwater flows and incorporate containment structures to contain and treat runoff to protect environmentally sensitive areas.
Potential Impact | Management Measure
--- | ---

- Maintain existing elements such as natural channels, wetland and riparian vegetation, where possible.
- Provide a stormwater management system which manages both the quality and quantity of stormwater as close to its source as possible, including devices which would treat stormwater and retain run-off so that the system changes the existing water regime by the smallest amount practical.
- By implementing these design measures, the proposal could have positive impacts on water quality due to additional treatment compared to existing infrastructure.

**Operation - Flooding**

As outlined in section 6.8.2, the flood study undertaken during the development of the concept design has resulted in the following aspects being incorporated into the concept design and project description for the proposal.

- The culvert extension to be laid at 0.1 per cent grade to assist in the balancing of flows between the eastern and western side of the highway during large events.
- Construction of a 20 cm high weir at the immediate exit to the proposed culvert extension to also assist in the balancing of flows between the eastern and western side of the highway during large events.
- Extension of the small existing levees on both banks of Cut Rock Creek downstream of the culverts. The levees would be constructed for 35 metres downstream of the culverts, and be designed for a 1 in 100 year storm event.

These aspects have been included in the concept design and are included in the project description for this REF. These inclusions would adequately manage the flood issues for the proposal and Cut Rock Creek and potentially have positive impacts on flooding of the adjacent areas and Cut Rock Creek during operation of the road.

All these aspects would be carried forward and included in the proposal at the detailed design stage to ensure mitigation of the potential flooding impacts. If any of the above aspects are to be removed or altered at the detailed design stage, an investigation would be undertaken to ensure that their removal/alteration has no impacts to the management of flood waters.

In addition, the drainage system that crosses the two existing vehicular accesses to the railway corridor between the Pacific Highway and Teralba Street would be upgraded with 900mm diameter pipe culverts to ensure floodwaters do not flow across the proposed highway.

During detailed design further assessments would be undertaken to ensure this is still the case. If, alternatively, the risk is deemed to be significant, measures would be designed into the drainage system to prevent spillages from reaching the downstream ecosystems and waterways. Depending on stormwater treatments, these measures may include:

- Stormwater channels that can be temporarily bunded to contain runoff.
- Lockable shut-off valves provided at points that discharge to natural watercourses.
- ‘First flush’ tanks sized to contain 1.2 times the potential spill volume (typically 25,000 litres) from a road tanker.

**Operation – Climate change**

Flood and hydrology assessments have considered the potential impact of climate change on patterns for the proposal. The proposed flood safeguards/management measures for the proposal outlined above would adequately manage potential changes to rainfall events as a result of climate change for the proposal lifetime.

**Air quality**

**Construction**

A Construction Environmental Management Plan (CEMP) would be developed prior to construction and would include a soil & water management sub-plan. This would include the following safeguards to
Potential Impact Management Measure

be implemented:

Dust

- Hardstands or similar would be provided in compound areas and work sites to reduce dust generation. Where possible, existing ground cover would be retained.
- Disturbed areas, stockpiles and handling areas would be maintained in a condition that minimises windblown, traffic-generated or equipment-generated dust. This would be done through activities including (but not limited to) watering, road sweeping and removal of accumulated material from environmental controls.
- Disturbed areas would be restored progressively, where possible, or at the completion of works.
- Where wind speeds reach a velocity that mobilises dust particulates, dust generating activities would cease and appropriate measures would be implemented to control dispersion.
- Dust deposition monitoring would be conducted at appropriate locations.
- The community would be informed of timing and reasons for works likely to generate high dust levels. A project hotline linked to the construction contractor would be available for complaints relating to construction.

Vehicle emissions

- Construction equipment and plant would be maintained in good working order.
- Equipment, plant and construction vehicles would be turned off when not in use.

Operation

No specific operational safeguards and management measures would be required. Operational impacts associated with air quality could be effectively managed through vehicle fuel standards, vehicle maintenance and emissions standards and testing, however this is outside the scope of this proposal and would be managed through broader government policies.

Greenhouse gas emissions

Below are a number of carbon abatement opportunities to be adopted where possible during detailed design and construction phases.

- Minimise vegetation clearance.
- Maximise on-site or local reuse of cleared vegetation (such as mulch or roadside habitat).
- Avoid double-handling of materials via temporary stockpiles.
- Minimise cut and fill activities.
- Minimise use of temporary pavements/structures. Temporary pavements would be heavy duty and resource-intensive with a high carbon penalty per m².
- Maximise reuse of existing and temporary pavements to reduce the need to import materials for permanent pavements/structures.
- Minimise import of materials for use in selected material zone and for use as general fill by utilising existing site materials, improved by stabilisation if required.
- Utilise existing materials (such as existing pavements or known/potential unsuitable materials) on site where possible.
- Minimise the use of cement and steel within the project where feasible. Both materials are very greenhouse intensive. Making provision within designs for use of partial cement substitutes (such as fly ash and ground granulated blast furnace slags) and recycled materials may lead to substantial carbon emission reductions.
- Minimise the use of temporary pavement materials.
- Avoid over specification of material quantities and properties (e.g., lower-strength concrete applications such as kerb and guttering provide good opportunities to reduce carbon emissions and demand on natural resources through use of recycled materials).
<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Management Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Minimise use of temporary structures.</td>
</tr>
<tr>
<td></td>
<td>• Identify opportunities to reduce cement, steel and aluminium use within the proposal in favour of lower emission materials.</td>
</tr>
</tbody>
</table>

### Geology and soils

#### Erosion and sediment control

A Construction Environmental Management Plan (CEMP) would be developed prior to construction and would include a soil & water management sub-plan. This plan would be based on the guidelines Managing Urban Stormwater: Soils and Construction (Landcom, 2004) and Managing Urban Stormwater: Volume 2D Main Road Construction (DECCW, 2008). All work would be carried out to avoid or minimise erosion of the site and the surrounding areas. Erosion and sediment control measures include:

- Minimise the area of land disturbed by construction.
- Clean water diversions would be installed to divert any off-site water around the site.
- Divert stormwater around disturbed areas to sealed or stabilised areas. Where this is not possible, convey stormwater across disturbed areas within a stabilised flow path.
- Dust suppression techniques would be implemented to minimise dust. This may include dampening of exposed soils and stockpiles.
- Dust generating works would not occur in high winds or weather events that may exacerbate the generation of dust.
- Soil and erosion controls would be established prior to any land clearing being undertaken.
- Land clearing activities would not be undertaken when large rainfall events are predicted.
- Traffic movements in the construction zone would be minimised to limit dust disturbance.
- Soil from vehicle wheels and undercarriages would be removed prior to exit from disturbed areas.
- Disturbed surfaces would be compacted at the end of each work day to reduce erosion potential. Any material transported onto pavement surfaces would be swept and removed throughout the day.
- A qualified soil conservationist would be engaged to inspect earthworks and drainage activities at appropriate intervals throughout the construction phase.
- Stockpile sites would be located at least 40 metres away from any waterways.
- Ensure that any imported topsoil complies with RTA QA Specification R178 - Vegetation.
- Disturbed surfaces would be re-vegetated as soon as practical to prevent extended exposure to erosion.
- Batters would be stabilised with geotextile fabrics, local native grasses and/or local native shrubs were needed, as soon as practical.
- Disturbed areas would be progressively rehabilitated as construction is completed.
- Regular inspections of erosion and sediment would occur after rain and during periods of prolonged rainfall.

Erosion and sediment control measures would apply to all areas which may be disturbed.

### Acid Sulfate Soil

- During detailed design, utility adjustments would be designed to minimise contact with areas and soil depths likely to contain acid sulfate soils.
- An acid sulfate soil management sub-plan would be included as part of the Construction Environmental Management Plan (CEMP) developed prior to construction.
- Where disturbance of acid sulfate soils causes' oxidisation, the excavated spoil suspected to contain acid sulphate soils would be set aside from other spoil for testing. Based on test results, acid sulfate soils would be treated with lime as per SPOCAS test recommendations and reused on-site, or disposed of off-site.
Potential Impact Management Measure

- Acid sulfate soils would be managed in accordance with the RTA Guidelines for the Management of Acid Sulphate Materials: Acid Sulfate Soils, Acid Sulfate Rocks and Monosulfidic Black Ooze (2005).

**Contaminated Soil**

During detailed design construction activities would avoid excavation of areas of potential soil contamination detected at the identified locations (BH321, BH336, TP342 and BH348).

A contamination management sub-plan would be included as part of the Construction Environmental Management Plan (CEMP) developed prior to construction. This would include:

- During excavation and relocation of underground services an inspection for potential presence of asbestos would be undertaken on all pipe work.
- All excavated contaminated spoil to be disposed of off-site would be analysed for classification according to the Office of Environment and Heritage (formerly Department of Environment, Climate Change and Water) Waste Classification Guidelines (DECCW, 2009) and transported to an appropriate disposal facility.
- If dewatering or deep excavations below groundwater levels are required, further investigations would be required to determine the nature and extent of contamination and to determine its impact on the proposed construction works.
- If contaminated soils or groundwater would be disturbed requiring remediation, a Contaminated Soils Remedial Action Plan would be prepared.

The results of the contamination assessment would be incorporated into an Occupational Health & Safety Plan to ensure the health and safety of construction workers and the general public is appropriately managed.

**Waste and resources**

A Construction Environment Management Plan would be developed prior to construction and would include a waste management sub-plan. This plan would include the following:

- Utilise recycled content materials and products with recycled content wherever these would be cost and performance-competitive, and where they are at least the environmental equivalent of non-recycled alternatives.
- Topsoil and vegetation removed during site clearance and earthworks would be reused on site where feasible.
- Recycle and reuse concrete or asphalt removed in areas of fill or landscaping if practical.
- Minimise disturbance of asphalt containing coal tar during detailed design by paving over the top of the existing pavement, reducing hazardous coal tar waste generated. Any coal tar requiring removal would be handled following appropriate guidelines and disposed of off-site at an appropriate facility.
- Maintain a waste register detailing types of waste collected, amounts, date/time and details of disposal. Collect waste transport and disposal receipts to ensure waste is being transported to authorised facilities.
- Recycle used oils and greases, or dispose at an appropriately licensed facility.
- Source any imported fill from licensed/registered suppliers within the local area.
- Separate waste according to type and store in temporary containers within the site compound for removal at regular intervals for reuse, recycling or disposal.
- Waste and recycling facilities would be provided for staff and office waste.
- The 'Australian Standard 2601:2001: The demolition of structures' and all appropriate OH&S legislation would be followed for the demolition of the existing bridge structure.

Prior to the demolition of any structures, an inspection would occur to assess the potential for the presence of asbestos or other hazardous materials. If hazardous materials are found on site,
measures to protect the health of workers and the general community would be developed. In order to reduce potable water consumption, alternate sources of water would be investigated including using treated water collected in sediment basins.

### 7.3 Licencing and Approvals

Table 7-46 indicates the likely licences and approvals required under NSW legislation for construction of the proposal. No licence or approvals would be required under Commonwealth legislation.

<table>
<thead>
<tr>
<th>Legislation</th>
<th>Authority</th>
<th>Approval / Licence</th>
<th>Criteria</th>
<th>Relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heritage Act 1977</strong></td>
<td>OEH</td>
<td>Exception Permit under s139(4)</td>
<td>For test excavations adjacent to Lisarow Cemetery</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Pesticides Act 1999</strong></td>
<td>OEH</td>
<td>Requirements for use and labelling of pesticides</td>
<td>Required if pesticides are used</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Protection of the Environment Operations Act 1997</strong></td>
<td>OEH</td>
<td>Environmental Protection Licence (EPL)</td>
<td>The construction contractor may apply for an EPL for a non-scheduled activity</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>OEH</td>
<td>Licence to receive waste</td>
<td>Required for destinations of waste from construction</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Dangerous Goods Act 1975</strong></td>
<td>OEH</td>
<td>Licence for storage, transport or disposal of industrial or hazardous waste.</td>
<td>Required if wastes are classified industrial or hazardous</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Threatened Species Conservation Act 1995</strong></td>
<td>OEH</td>
<td>Permit to collect Melaleuca biconvexa seed.</td>
<td>Required for inclusion in landscaping</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Fisheries Management Act 1994 - Section 199</strong></td>
<td>DPI Fisheries</td>
<td>Notification of Minister of works that would involve reclamation.</td>
<td>Required for culvert works at Cut Rock Creek south</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Fisheries Management Act 1994 - Section 219</strong></td>
<td>DPI Fisheries</td>
<td>Permit for works that would block fish passage.</td>
<td>Potentially required for works during construction at Cut Rock Creek crossings</td>
<td>Yes</td>
</tr>
</tbody>
</table>
8 Justification and Conclusion

8.1 Principles of Ecologically Sustainable Development

The principles of ESD are considered in terms of the proposal below in Table 8-47.

<table>
<thead>
<tr>
<th>ESD Principle</th>
<th>Relation to Proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precautionary Principle</td>
<td>A precondition for the operation of the precautionary principle is that there are threats of serious or irreversible environmental damage. This REF has demonstrated that such threats are not present for the proposal. Therefore, the precautionary principle does not operate. Regardless, the proposal has sought to take a precautionary approach to minimise environmental impacts. This has also been applied in the development of safeguards and management measures.</td>
</tr>
<tr>
<td>Intergenerational Equity</td>
<td>The proposal provides a balanced outcome for existing and future generations within and adjacent to the study area. The proposal would improve access for all users, and improve ecological values by weed removal and landscaping with native local species. It is acknowledged that the proposal may have some adverse impacts. However, these are not considered to be of a nature or extent to disadvantage future or existing generations.</td>
</tr>
<tr>
<td>Conservation of Biological Diversity and Ecological Integrity</td>
<td>The proposal would not compromise the biological diversity or ecological integrity of the study area. As noted in section 6.1, the study area has been highly modified as a result of urban settlement and infrastructure, resulting in weed infestation and loss of native species and ecological values. The measures outlined in the section 6.1 indicate that potential impacts would be minimised, and would restore some ecological values by weed removal and landscaping with native local species.</td>
</tr>
<tr>
<td>Improved Valuation and Pricing of Environmental Resources</td>
<td>Environmental and social issues were considered in developing the concept design for this proposal. The value placed on environmental resources is evident in the extent of the planning, environmental investigations and design of safeguards and management measures.</td>
</tr>
</tbody>
</table>

The principles of ESD were considered in the development of options, selection of the preferred option, the Concept Design and the development of environmental safeguards and management measures. They are discussed throughout the document in relation to specific issues.

8.2 Justification

On a strategic level, the proposal forms a crucial part of the NSW Governments’ long-term goal to upgrade the Pacific Highway to improve safety and accommodate increasing traffic related to urban growth, commuters, schools and freight.

On a specific level, the proposal is needed to improve road safety by reducing the severity and incidence of road accidents, reduce traffic congestion and travel times.

The proposal would:
- Improve road safety by reducing traffic conflicts and congestion.
- Reduce traffic congestion using additional lanes to provide additional traffic capacity and to improve level of service.
- Accommodate traffic growth, as traffic volumes are expected to increase over the next 20 years which would place further strain on an already congested highway.
- Accommodate economic and population growth in the central coast area.
- Improve the amenity and visual quality though landscaping and urban design.
- Improve ecological values in the study area by reducing weed infestation and planting local native species.
- Improve pedestrian and cyclist facilities using new on-road and off-road pedestrian and cyclist facilities along the length of the proposed upgrade that link to other upgraded sections.
- Improve bus facilities using new indented bus bays and new bus shelters.
- Be consistent with strategic planning, as the highway is a key route on the Central Coast.
- Be consistent with other upgrades along the Pacific Highway.

8.3 Conclusion

The proposed Pacific Highway Lisarow to F3 Stage 3A (Lisarow to Ourimbah) upgrade is subject to assessment under Part 5 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity. A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impacts on:

- Clearing of up to 240m² of canopy cover of the *Melaleuca biconvexa* (threatened species under the TSC Act and EPBC Act) in six independent patches.
- Changes to the structures in Cut Rock Creek including:
  - Removal of existing bridge piers (replacing with twin single span bridges with no piers in the waterway).
  - The extension of the existing culverts from 17 metres to 37 metres
  - The inclusion of a 200mm high weir at the immediate exit to the culvert extension.
- Full acquisition of four properties and partial acquisition of a further 13 properties adjacent to the proposal.
- Temporary reduction in air quality during construction, mainly due to dust emissions.
- Temporary noise and vibration impacts during construction.
- Increased noise levels at some properties during operation.
- Temporary impacts on traffic arrangements and access throughout construction.
- Impacts on the available open space and amenity at Lions Park throughout construction.

Mitigation measures as detailed in this REF would ameliorate or minimise these expected impacts.

The proposal would also have positive impacts including:

- Improved access arrangements at three intersections along the Pacific Highway.
- Improved safety for vehicles travelling along the Pacific Highway.
- Provision of a shared pedestrian/cycle path along the length of the proposal improving safety and access for pedestrians and cyclists.
- Improved bus bay facilities along this section of the Pacific Highway.
- Improved access for heavy vehicles into the industrial/commercial area adjacent to the proposal.

On balance the proposal is considered justified.

The environmental impacts of the proposal are not likely to be significant and therefore it is not necessary for approval to be sought for the proposal under Part 3A of the EP&A Act. The proposal is unlikely to affect threatened species, populations or ecological communities or their habitats, within the meaning of the Threatened Species Conservation Act 1995 or Fisheries Management Act 1994 and therefore a Species Impact Statement is not required. The proposal is also unlikely to affect Commonwealth land or have an impact on any matters of national environmental significance.

9 Certification

This Review of Environmental Factors provides a true and fair review of the proposed activity in relation to its likely effects on the environment. It addresses to the fullest extent possible all matters affecting, or likely to affect, the environment as a result of the proposed activity.

<table>
<thead>
<tr>
<th>Name</th>
<th>Julian Galloway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signed</td>
<td></td>
</tr>
<tr>
<td>Designation</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Organisation</td>
<td>Hyder Consulting Pty Limited</td>
</tr>
<tr>
<td>Date</td>
<td>20 June 2011</td>
</tr>
</tbody>
</table>

I have examined this Review of Environmental factors and the certification by Hyder Consulting Pty Ltd and accept the Review of Environmental Factors on behalf of the Roads and Traffic Authority.

<table>
<thead>
<tr>
<th>Name</th>
<th>Chris Dransfield</th>
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<tbody>
<tr>
<td>Signed</td>
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<td>Organisation</td>
<td>Roads and Traffic Authority</td>
</tr>
<tr>
<td>Date</td>
<td>20/6/11</td>
</tr>
</tbody>
</table>
10 References


Department of Environment, Climate Change and Water (2005) Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW.


Department of the Environment and Heritage 1992, National Strategy for Ecologically Sustainable Development


Environmental Assessments (2008) Preliminary Environmental Investigation, Lisarow to F3 Stage 3: Railway Crescent, Lisarow to Glen Road, Ourimbah. Prepared for the RTA.


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Roads and Traffic Authority NSW (2008a) *Environmental Impact Assessment Guidance Note: Preparing a Review of Environmental Factors*, EIA-PO5-GN03


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